MACHINERY

OCTOBER 29, 1958 ONE SHILLING & THREEPENCE



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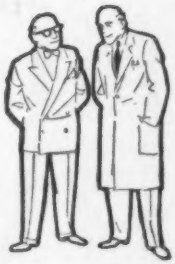


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An arrangement of stepped magnetic chucks on the 48" diameter rotary table of this Lumsden model MLS Single Headed Continuous Grinder ensures the maximum output of connecting rods at the Coventry works of Morris Motors. Both faces are ground in a transfer system where a component roughed on one chuck is finished on the next. The power, speed of operation and rigidity of this machine are features common throughout the extensive range of Lumsden Surface Grinders, which includes machines with single or multiple heads as required. Write for our illustrated catalogue which contains full details and specifications.

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MODEL 91 MLS

Continuous SURFACE GRINDERS





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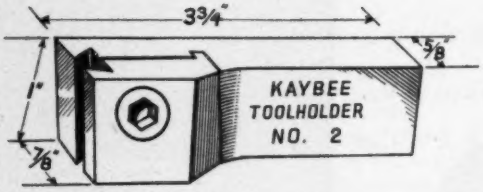
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DESIGNS PENDING, PATENT APPLIED FOR

The "KAYBEE"

TANGENTIAL PARTING TOOL AND HOLDER

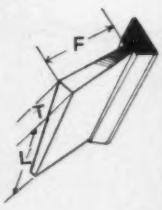


- ROBUST . . . EASY TO SET
- MINIMUM OVERHANG FOR MAXIMUM RIGIDITY
- REGRINDING REQUIRED ON ONE FACE ONLY
- TOOLS MADE FROM 20% TUNGSTEN, 10% COBALT STEEL

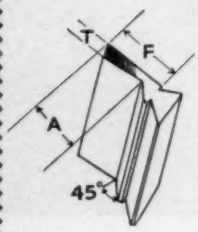
- Standard clearance angles throughout length of blade.
- Reducing regrinding to top rake only, without disturbing setting.
- Length of blade ensures maximum number of regrinds.
- Minimum overhang from tool post gives exceptional rigidity to blade.
- No packing required to attain centre height.
- Blade may be positioned to within .275 of collet face.
- Overloading forces tool down and away from cut, minimising breakages.

PARTING OFF
TOOL DIMENSIONS

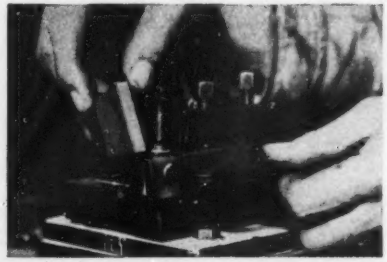
TOOL No.	F	T	L
48	2/16"	1/8"	1 5/8"
68	13/16"	5/32"	1 3/4"
88	1 1/16"	3/16"	1 3/4"



PARTING OFF & CHAMFERING
TOOL DIMENSIONS



TOOL No.	F	T	L	A
24	11/16"	1/8"	1 1/8"	3/8"
34	13/16"	1/8"	1 3/4"	1/2"
44	1 1/16"	5/32"	1 3/4"	3/4"



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A. & T. KNOTT BROS. LTD

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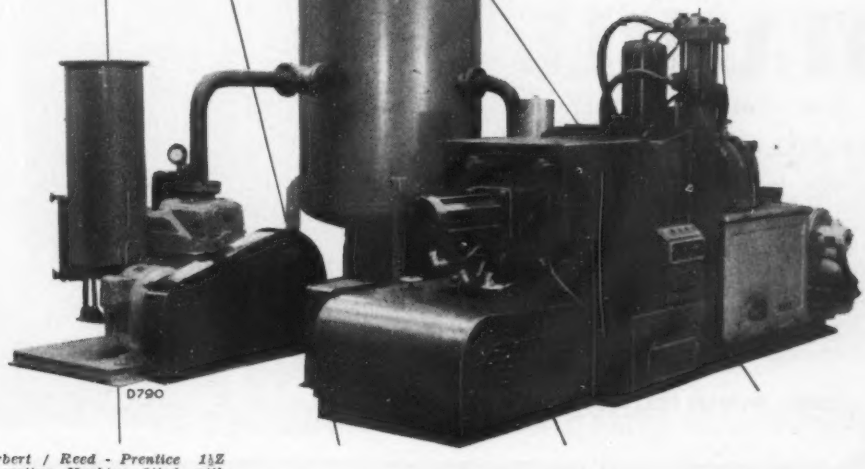
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an exclusive new process that:—

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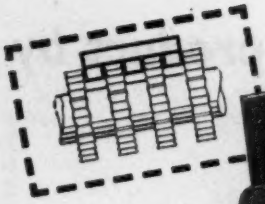
This equipment can be supplied for Herbert/ Reed-Prentice Machines, either new or already installed, and also for machines of other makes. It is necessary for intending users, before ordering, to apply for a licence to Sparklets Ltd., Queen Street, Tottenham, London.



Herbert / Reed - Prentice 1½Z Diecasting Machine fitted with Vacucast equipment.

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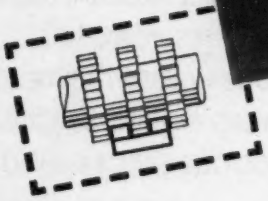


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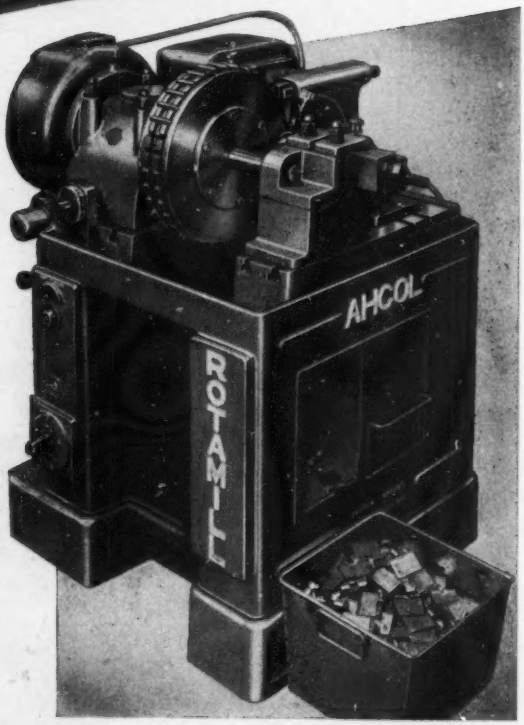
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With Automatic Work-Clamping and continuous cycle, the ½" x ½" slots and end faces of these components, in brass, were gang milled at 1,400 and 1,600 pieces per hour — typical of the impressive times being regularly recorded on this amazing machine.

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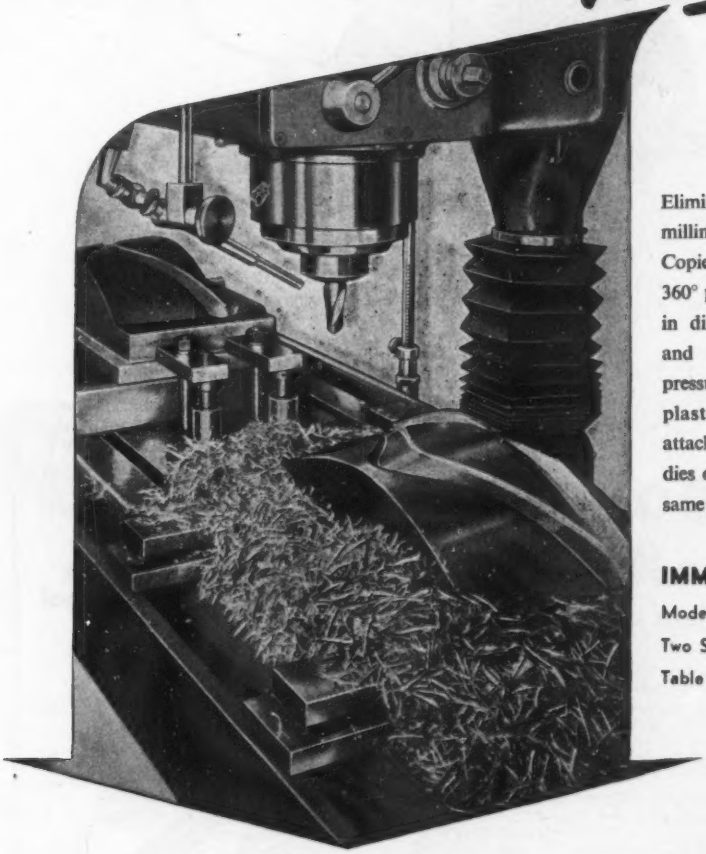
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Make your Die Sinking *Automatic*



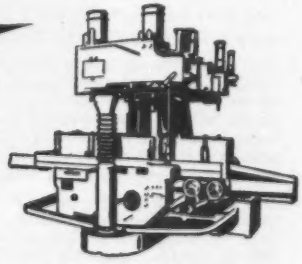
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Two Spindles

Table size 92½" × 23½"



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***AUTOMATIC* HYDROCOPYING MACHINES**

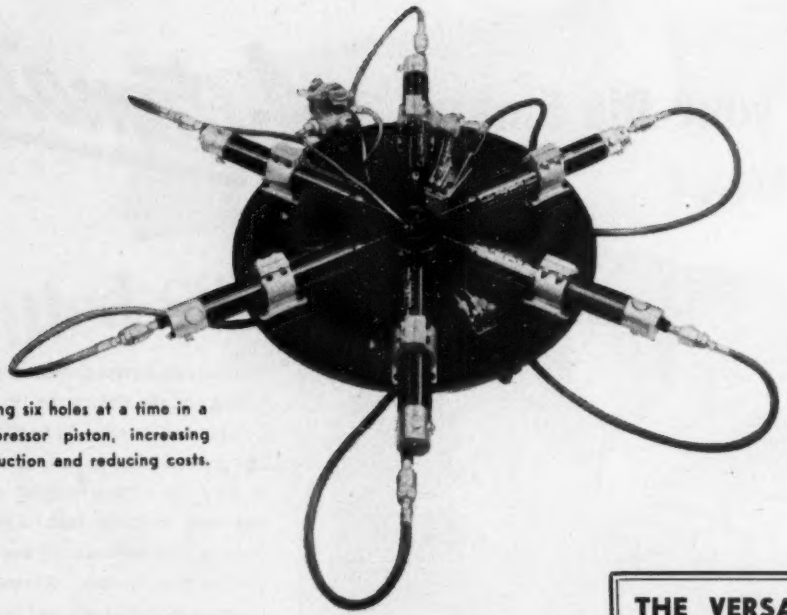
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Par-A-Matics are compact, self-feed pneumatic tools designed for multiple drilling, burring, tapping, grinding, reaming, nut-running, positioning . . . almost any operation requiring rotating tools which can be accommodated in a $\frac{1}{2}$" or $\frac{1}{16}$" chuck.

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Par-A-Matics are invaluable for long or short production runs. Gears are interchangeable for speedy conversion to any of seven speeds from 500 to 17,000 r.p.m. You can easily mount Par-A-Matics at any angle for automatic or semi-automatic operation. You can link any number for simultaneous functioning. One man, using a remote control valve, can operate a whole battery of Par-A-Matics.

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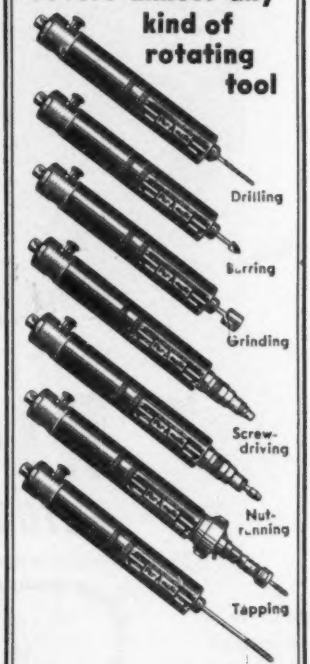
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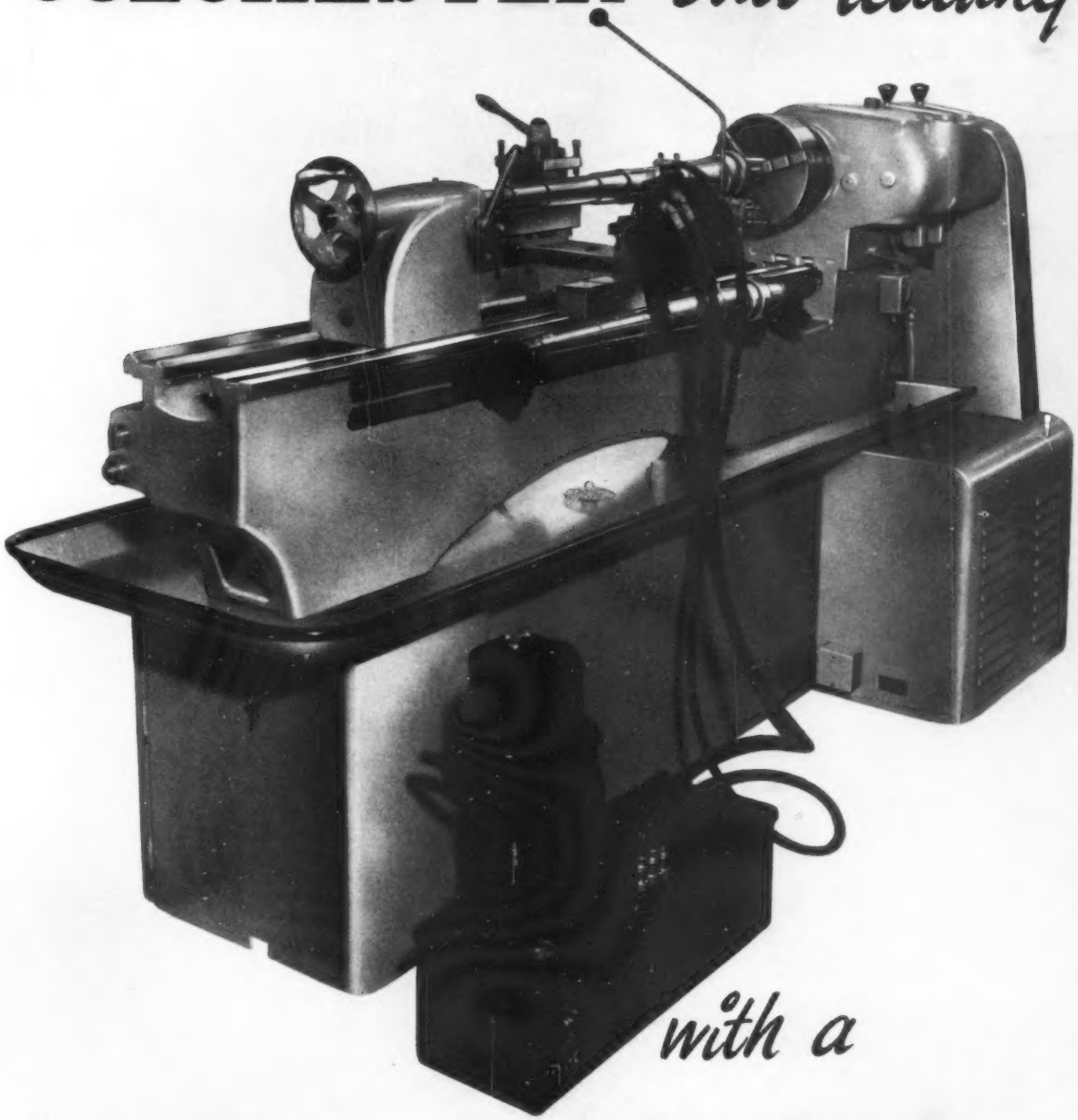
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THE VERSATILITY OF PAR-A-MATICS covers almost any kind of rotating tool



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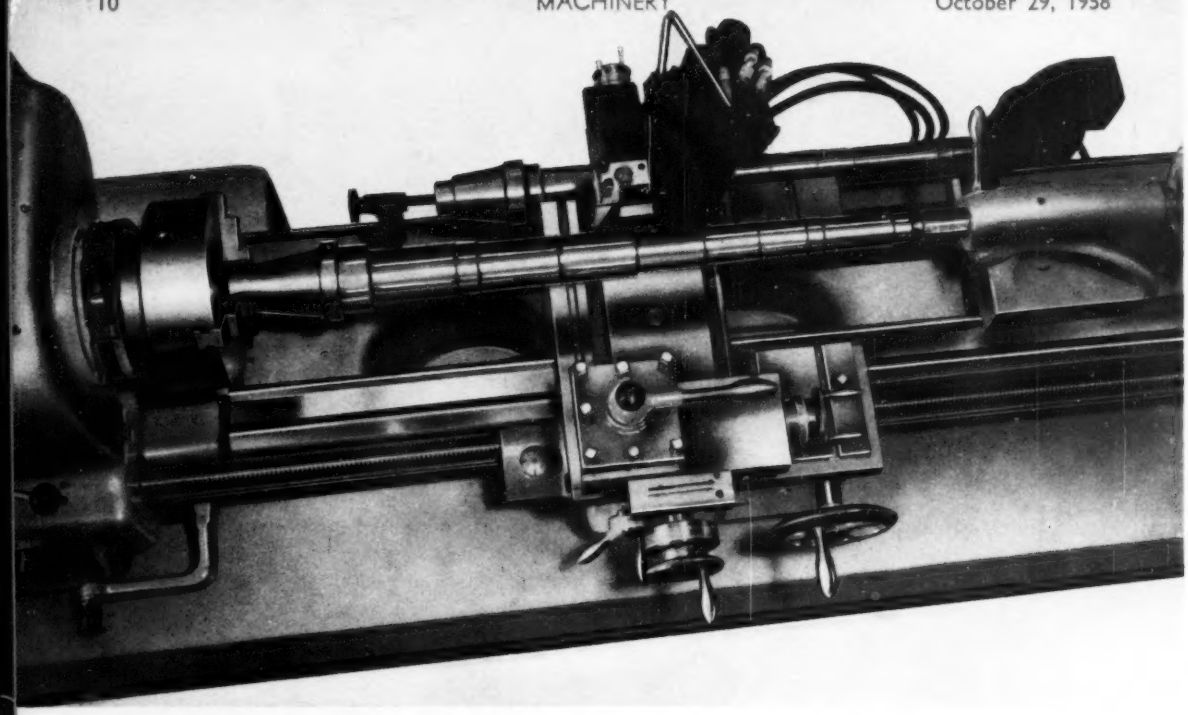
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★ **CONSISTS OF THREE BASIC FULLY INTERCHANGEABLE ASSEMBLIES.**

★ **IDEAL FOR MACHINING SLOW TAPERS, ETC.**

★ **DEPTH OF CUT CONTROLLED FROM OPERATING POSITION.**

★ **DOES NOT IMPEDE USE OF MACHINE AS NORMAL LATHE.**

This new hydraulic copying attachment is the most reasonably priced attachment yet offered, and is available to users of COLCHESTER TRIUMPH lathes. Other models are available for the 5in. CHIPMASTER, 6in. STUDENT and 6½in. MASTER.

Mounted directly onto the rear of the cross slide, the unit incorporates a potentiometric rather than the more conventional zero-lap type of hydraulic tracer valve. This avoids many of the troubles associated with zero-lap valves. Slow tapers can be turned accurately and with confidence. The unit can be used for taper turning, boring and facing on chucked components, taper threading, and threading of components up to a shoulder without the necessity of an undercut.

Three assemblies are linked to form the complete unit; the piston and cylinder assembly, the rear beam assembly and the free standing pump unit.

The piston and cylinder assembly is complete with the tracer valve unit and a mechanical retraction lever. The copying topslide carries a depth of cut adjusting handwheel which enables the depth of cut to be controlled from the normal operating position. Mounted at 60 deg. to the longitudinal axis of the bed, the copying slide can be retracted to such an extent that the attachment in no way impedes the normal use of the machine.

A specially ground and tapped pad is provided on the rear of the bed to accommodate the rear beam assembly consisting of a specially sectioned bar and two tailstock assemblies which carry the circular master between centres: this allows standard parallel masters to be used for taper turning.

The free standing pump unit has a pressure gauge mounted on the top in front of the vertical flange mounted pump motor. Motor switchgear is mounted on top of the motor, and connection between the pump unit and the piston unit is by three standard flexible hoses.

SPECIFICATIONS

PROFILER		TRIUMPH LATHE	
Maximum copying diameter	6in.	Height of centres	7½in.
Maximum copying length	30in. or 48in.	Distance between centres	30in. or 48in.
Minimum depth of profile in one setting	3in.	Swing over bed	15in.
Maximum front angle	5° undercut	Swing over cross slide	9in.
Maximum back angle	40°	8 spindle speeds	40 to 800 r.p.m.
H.P. Hydraulic pump motor	½	H.P. motor	3

TRIUMPH *lathe complete with Hydraulic Profiling Attachment*

£771 *(30" between centres)* ***£805*** *(48" between centres) both nett ex works*

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Hythe, Colchester, Essex

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The fastest way to cut Keyways

WGW

INTERNAL KEYSEATERS

INFINITELY VARIABLE CUTTING SPEEDS ENSURE MAXIMUM PERFORMANCE—REGARDLESS OF SIZE

For the rapid and economical cutting of keyways and splines, these machines are unsurpassed. No marking out of parts is required, and several components may be machined at one pass. Tooling is very simple, and provision is made for the cutting of taper keyways and splines. Only a small space is required for the machine, which can carry up to 10 tons in weight, of almost any size.

MODEL NZH 70 as illustrated

CAPACITY

KEYWAYS ..... ⅜" to 2¼" wide
CUTTING SPEED (Infinitely variable) ... 13 to 39½ft. per min.
WORK SIZE ..... unrestricted
WORKPIECE WEIGHT ..... up to 10 tons

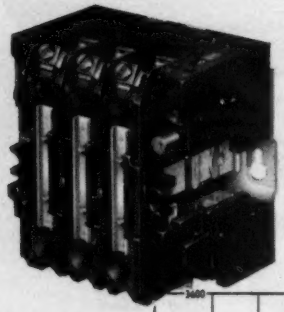
One machine for keyways up to 20½in. long. Available immediately from London Stock.



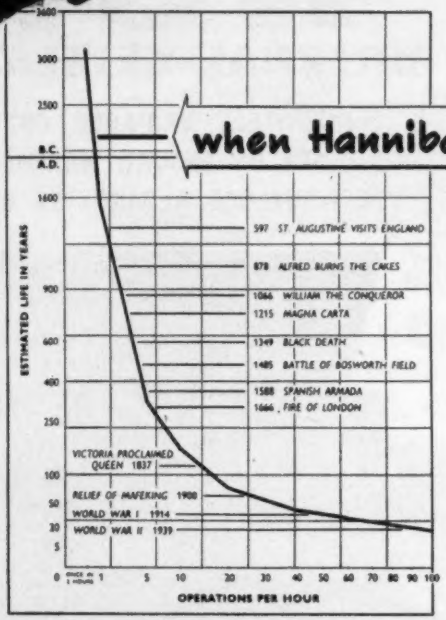
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if this CRABTREE starter could have been installed



when Hannibal crossed the Alps



GRAPH SHOWING TIME TAKEN IN YEARS RELATED TO 4,100,000 OPERATIONS PERFORMED BY CRABTREE TYPE B-15 CONTACTOR (BASED ON A 50-HOUR WEEK AND A 52-WEEK YEAR)

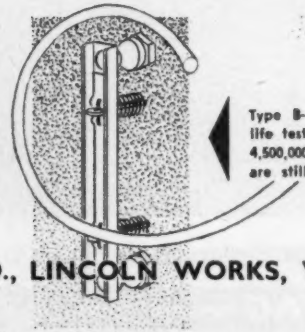
The contacts would now need inspection

Tests are now proceeding in which Crabtree Type B-15 starters are being used for repeatedly stopping and starting motors. To date, the starters have given the following operations (start and stop) without change of contacts

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Type B-15 contacts, on actual motor-load life tests, have already achieved 4,500,000 operations (start and stop) and are still giving satisfactory service.

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C780



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3 h.p. 2CE with 16 speeds

25 to 1,300 r.p.m. (Horizontal) 30 to 1,575 r.p.m. (Vertical)

and 16 feeds — ¼ inch to 25 inch

7½ h.p. 3CE with 16 speeds

25 to 1,300 r.p.m. and 16 feeds — ¼ inch to 25 inch

Both models are fitted with independent feed drive motors and are available as Plain, Universal and Vertical styles. Both Plain and Vertical Machines can also be fitted with automatic cycle table control.

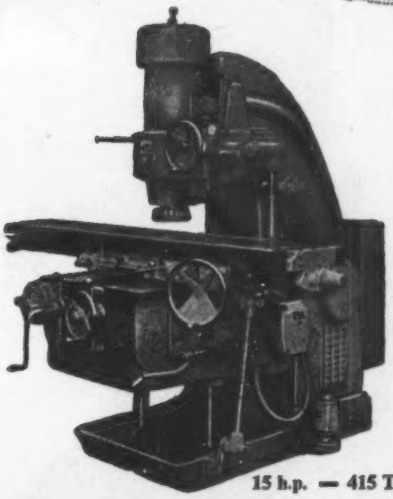
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Complete series of Model 3 and 4 T.F. Machines in Plain, Universal and Vertical styles from 10 h.p. to 30 h.p. Monolever and automatic cycle table control is standard on all styles.

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Also available is the 2D Rotary Head Machine with its unique action enabling the most complex jobs to be completed in a single set-up.

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15 h.p. — 415 T.F.

E.H. JONES (MACHINE TOOLS) LTD

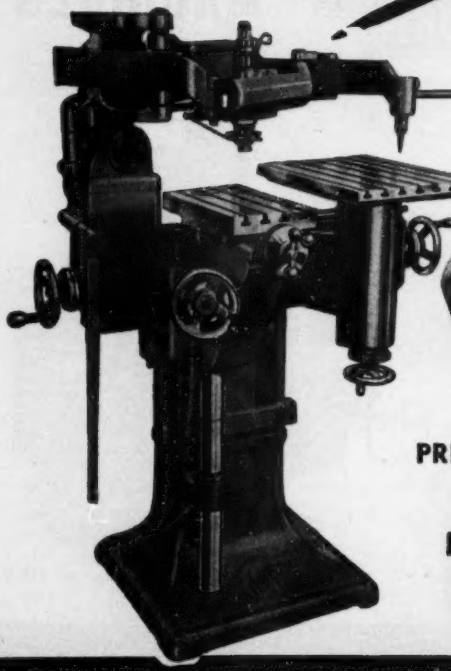
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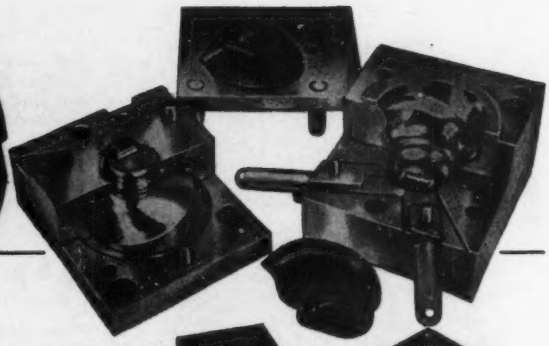
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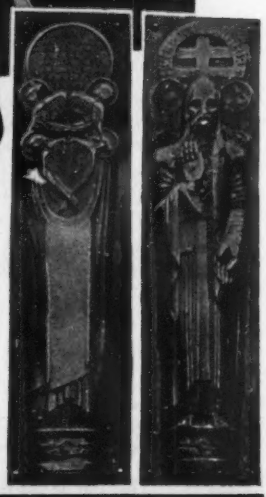
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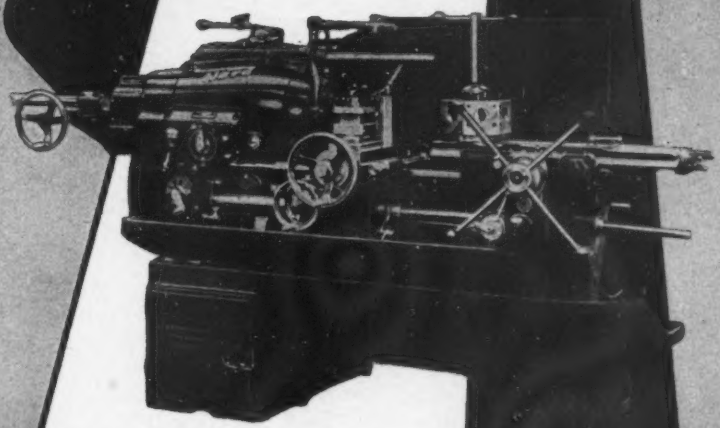
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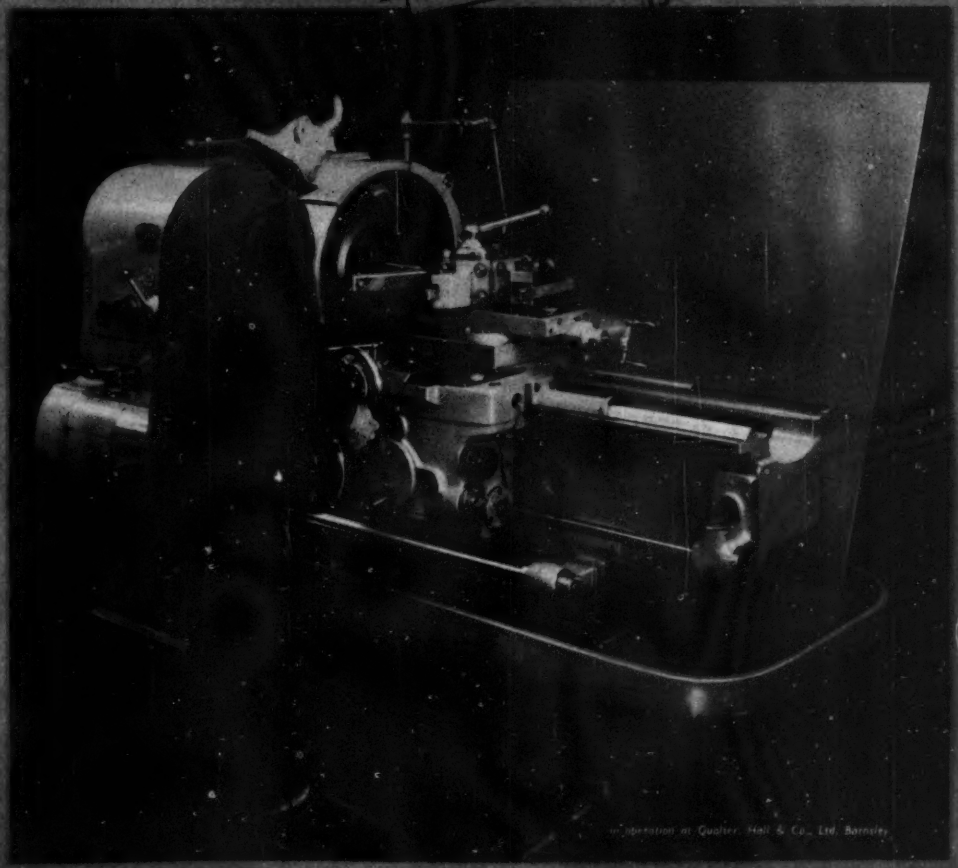
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model JC6

SURFACING & BORING LATHES.

- 12 spindle speeds—Nickel chrome, hardened and ground gears.
- Pre-loaded spherical roller bearing spindle and the bearings pump lubricated with filtered oil.
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- Hardened steel wear strips on under sideway faces of saddle.
- All controls conveniently grouped.

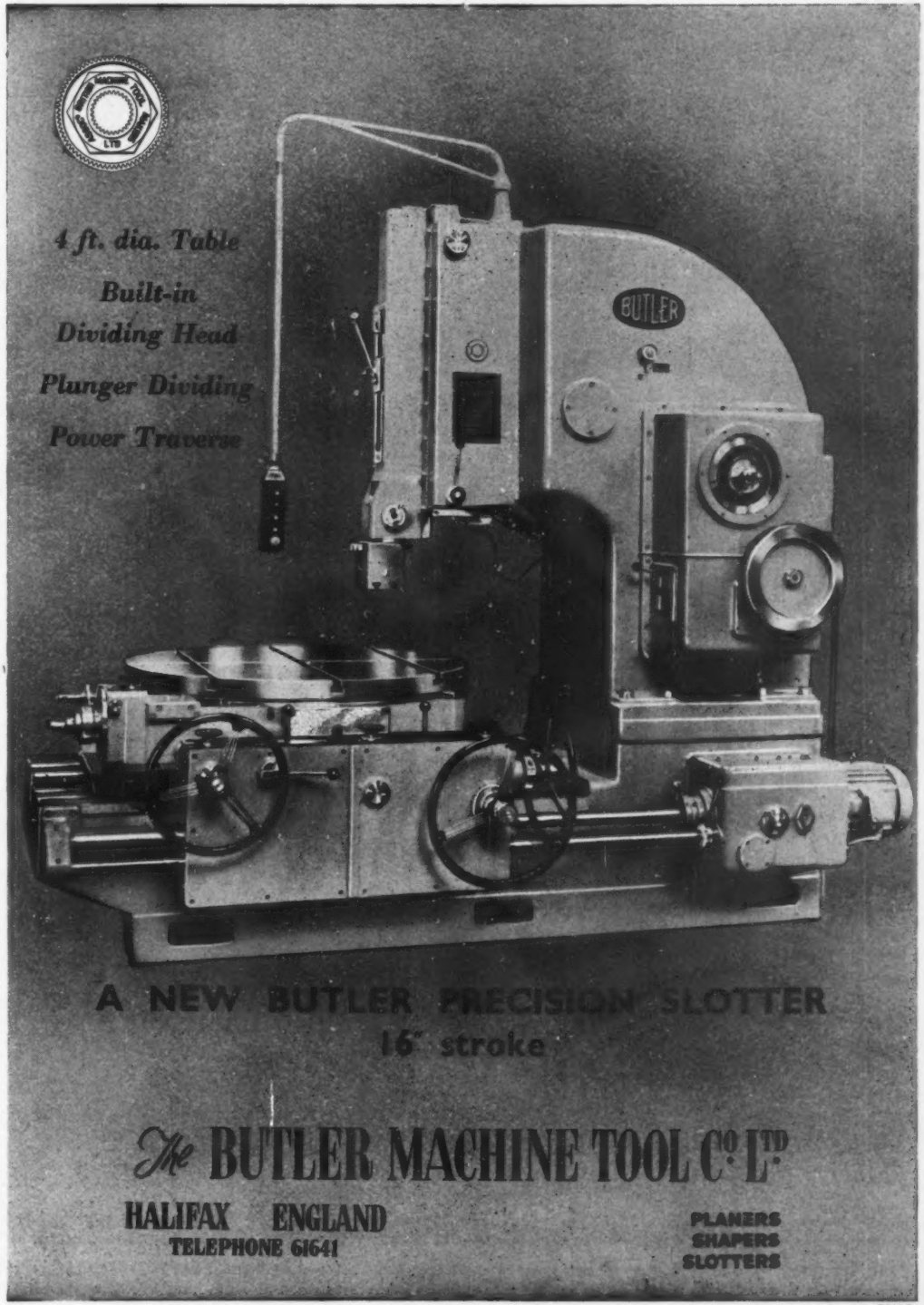
13" AND 17" SWING.

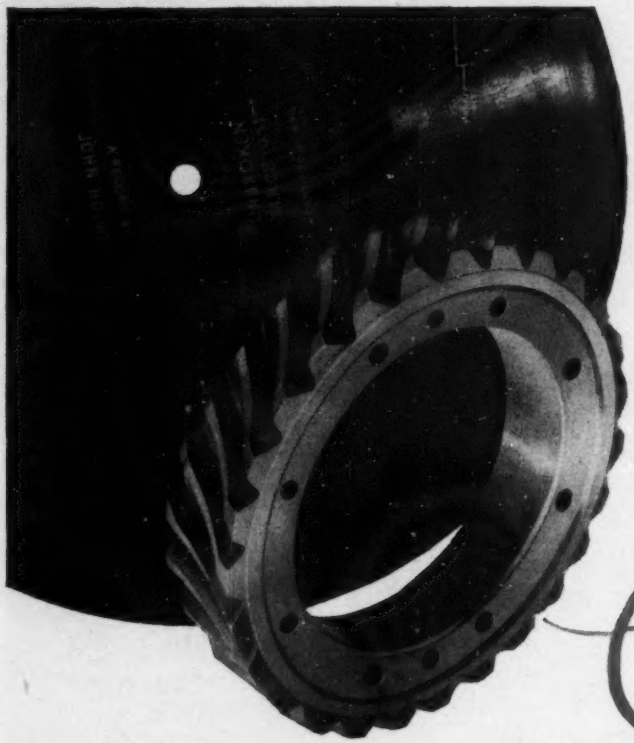


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Built-in
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BUTLER
A NEW BUTLER PRECISION SLOTTER
16" stroke
The BUTLER MACHINE TOOL Co. LTD.
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a record turn

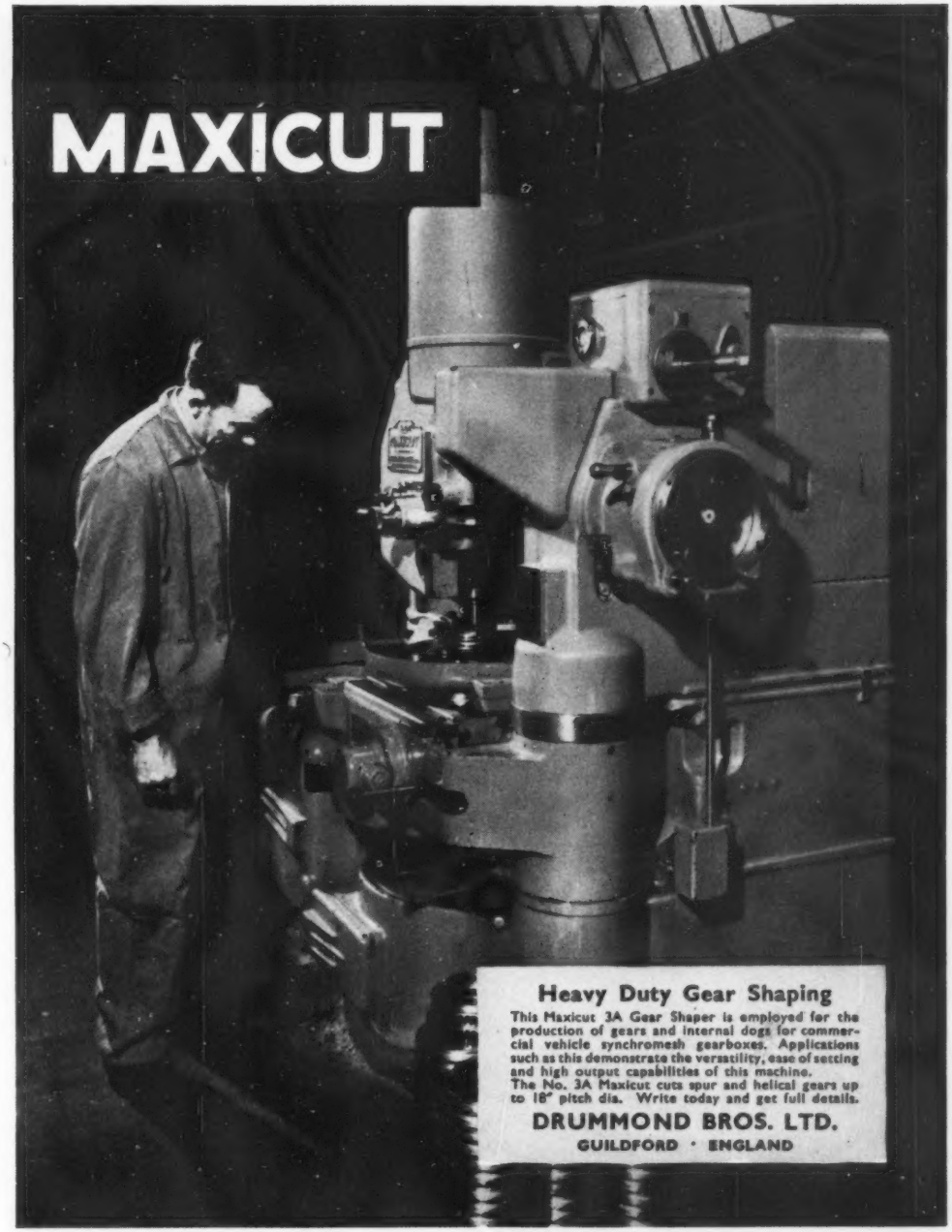
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The record was established about a quarter century ago but since then research has continued and this is reflected in the quality of the present day product.
Furthermore our capacity has been extended to cover the large wheels as well as the medium and small.

SUPER-HOLFOS BRONZE (Regd.)

HOLROYD-WALKER worm gears, which, tested independently at the National Physical Laboratory in 1931, created a WORLD RECORD in worm gear efficiency giving figures of over 98% efficiency. The wheel was made in SUPER-HOLFOS BRONZE.

JOHN HOLROYD & CO. LTD., P·O·BOX No. 24, HOLFOS WORKS, ROCHDALE, LANCS. ROCHDALE 3155



Sales & Service for . . . **DRUMMOND-ASQUITH** . . . the British Isles

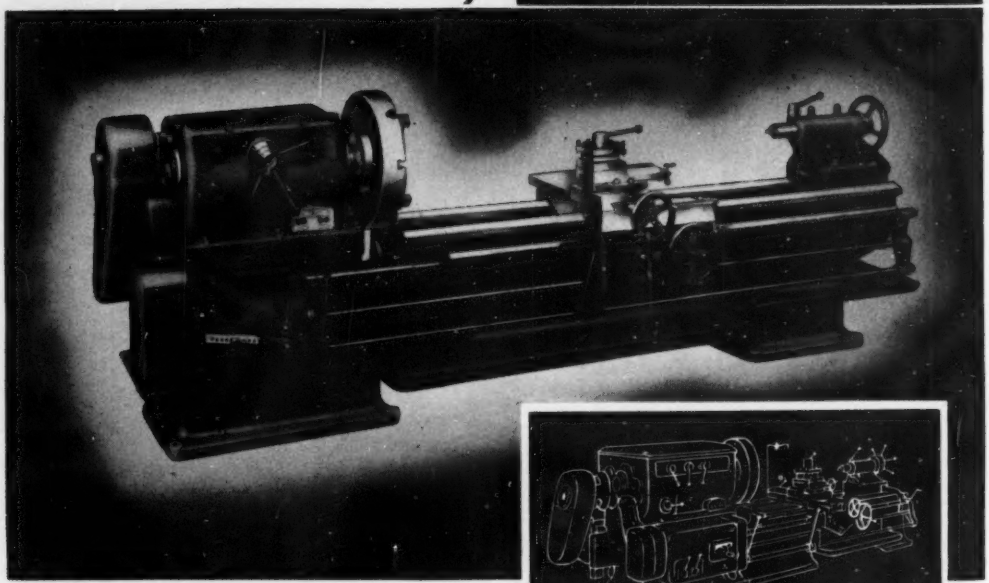
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'Phone: Midland 3431 (7 lines) Grams: Maxishape, Birmingham. Also at LONDON: 'Phone: Trafalgar 7224 (5 lines) and GLASGOW: 'Phone Central 0922

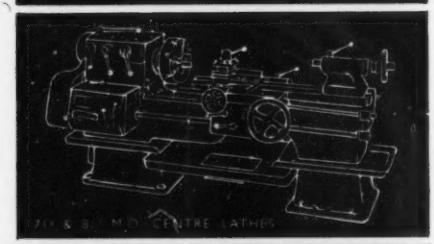
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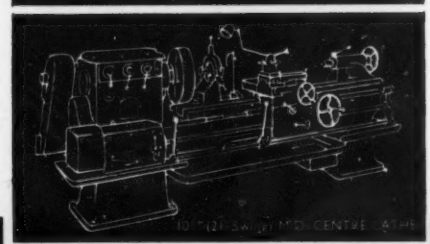
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SUPERB LATHES by CROWTHORN



12"/12½" H.D. CENTRE LATHE





The well known versatility of Crowthorn lathes is further enhanced by the range of attachments. Almost any machining operation can be performed with consistent precision.

Please write for fully detailed literature.

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CL 88



Just cut them off

and they are ready to weld to—

RECTANGULAR HOLLOW SECTIONS

R. H. Sections, having flat sides, eliminate the need for special shaping of component structural members prior to welding. Any straight-cut R.H. Section or tube will fit accurately against them, whether square-on or at an angle, and, moreover, lugs of various kinds produced from tube or bar are easily attached.
Welding is simple and no bevelling is necessary.

SIZES. 16 standard sizes of hot-rolled R.H. Sections are available, each in two thicknesses; they range from $1\frac{3}{8}$" square to 5" x $2\frac{1}{8}$". Several sections have matching dimensions and this is of advantage in the production of neat fabricated structures. The 1·90" square R.H.S., for example, matches the short sides of a 3·68" by 1·90" R.H.S.; these matching dimensions are made clear in our pamphlet.

Welded steelwork using R.H. Sections alone, or in conjunction with tubes, is completely sealed; thus only the outside requires painting and there are no recesses to trap dirt or moisture.
Our subsidiary, Tubewrights Ltd., of 25 Buckingham Gate, London, S.W.1, is willing to advise on or quote for any welded sub-assemblies or complete units in R.H.S., in tubes, or in a combination of both.

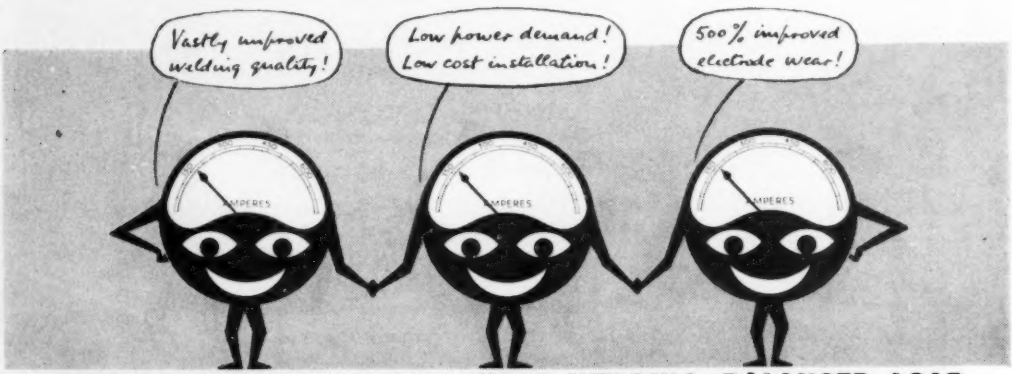
R.H. Sections are sold in 21 ft. lengths in standard bundles and are stocked at S & L warehouses throughout the country.

Pamphlet giving full dimensions, properties and prices will be sent on application to:

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STRUCTURAL STEEL DEPARTMENT, BROAD ST. CHAMBERS, BIRMINGHAM, 1





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THE RALEIGH CYCLE CO LTD
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OUR REF. LCC/JN.
YOUR REF. JEW/MB.

25th April, 1958.

Wickman Limited,
Head Office and Machine Tool Works,
Post Office Box No.44,
Banner Lane,
Tile Hill,
COVENTRY.

For the attention of Mr. R.J. Dixon, Chief Engineer.

Dear Sir,

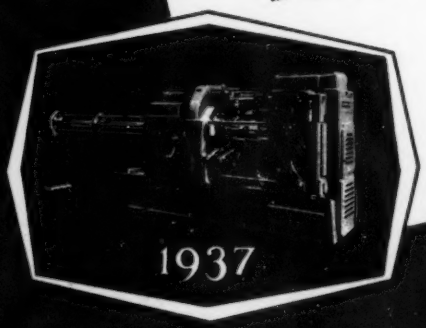
In reply to your enquiry we are pleased to confirm that the first A.C. Wickman Automatic made by your Company was delivered to us 21 years ago, and we are happy to pay tribute to the service and reliability we have experienced.

As you know, since its installation the Raleigh Company have ordered and installed a considerable number of these machines to meet the continued expansion of our production requirements.

Undoubtedly the confidence in Wickman Automatics stems from the satisfactory service which we have secured and which we now accept as normal.

Yours faithfully,

WORKS DIRECTOR.

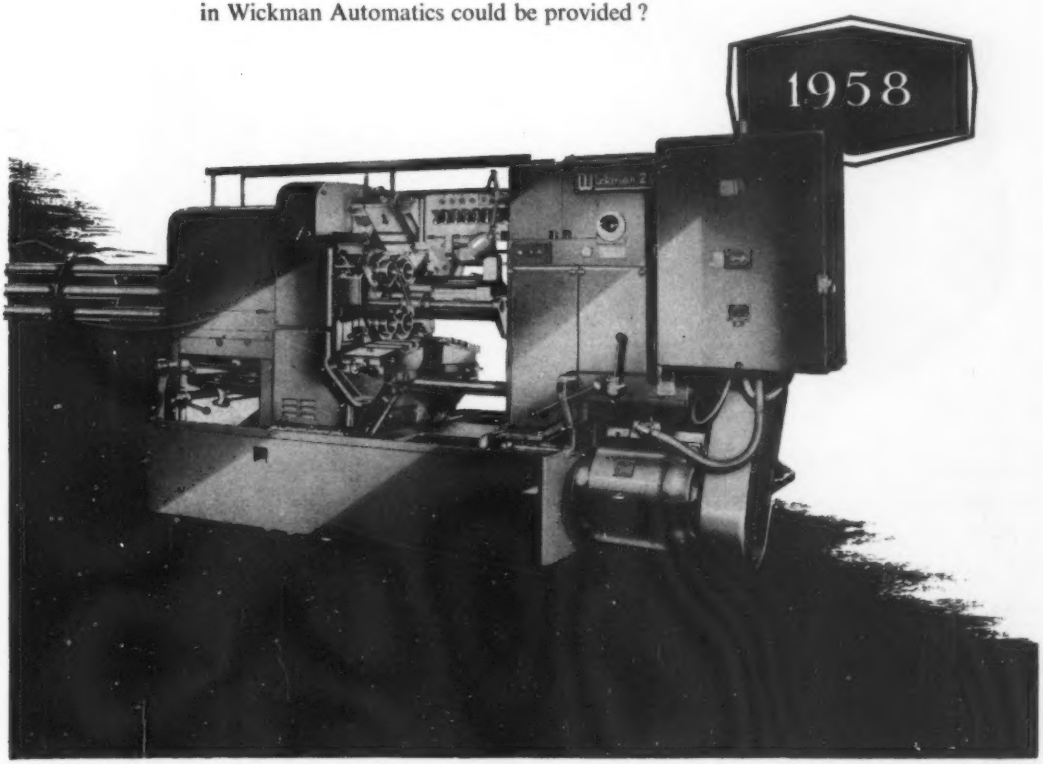


. . . *in the long run* . . . .

During its lifetime a high-production machine tool does not normally receive the care and attention conducive to a long life.

That such attention is worth-while is proved by this report concerning the performance of one of the earliest Wickman automatics ever made, and delivered to the Raleigh Cycle Company in 1937.

What better testimony to the quality of materials and workmanship in Wickman Automatics could be provided ?



527 WM

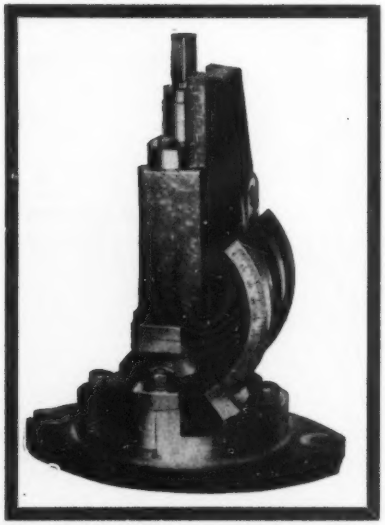
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THE ABWOOD UNIVERSAL MACHINE VICES



Suitable for jig boring, grinding, milling and shaping machines. Note the clean design, low height, and rigid mounting. The angle cannot alter once the clamps have been locked. Available in two sizes, 4in. and 6in. jaw widths.

This vice is accurately indexed 0-90° for angular work with spot sight and knife edge for register. The swivel base is indexed through 360° so that any combination of angles may be obtained.

ABWOOD MACHINE TOOLS LTD. PRINCES ROAD, DARTFORD, KENT

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UV-1

In answer to demand

for compact, lightweight, inexpensive

SHEET METAL GUILLOTINES

F. J. Edwards have produced the NEW BESCO ALL STEEL PRODUCTION MOTORISED GUILLOTINES

The frames cannot be broken by even extraordinary factory use, being of welded steel plate construction.
Planned to a price and designed for a job, they will cut their capacity day after day.
A new design clutch, which is simplicity itself; all round and accurate gauges, and an automatic built-in hold-down, make the operator's job easier, quicker and safer.
And they are from London stock too.



Fuller details will be sent on request together with prices and, if required, information concerning deferred payments in the United Kingdom.

In addition to cutting all kinds of sheet metal, these machines are also suitable for cutting fibre, plastics, mica, rubber, paper, card, with the blade ground to a special angle.

MODEL	UNGEARED	GEARED	GEARED
Capacity	36½" x 18 S.W.G. mild steel	36½" x 16 S.W.G. mild steel	49" x 16 S.W.G. mild steel

Designed and built by . . .

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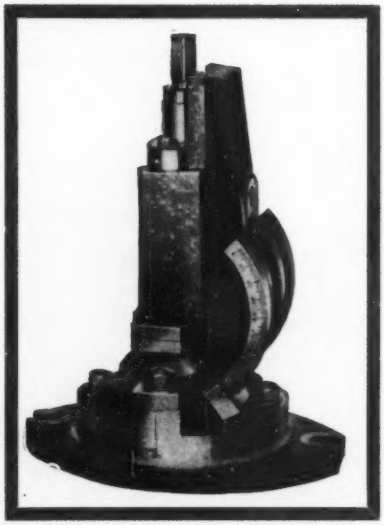
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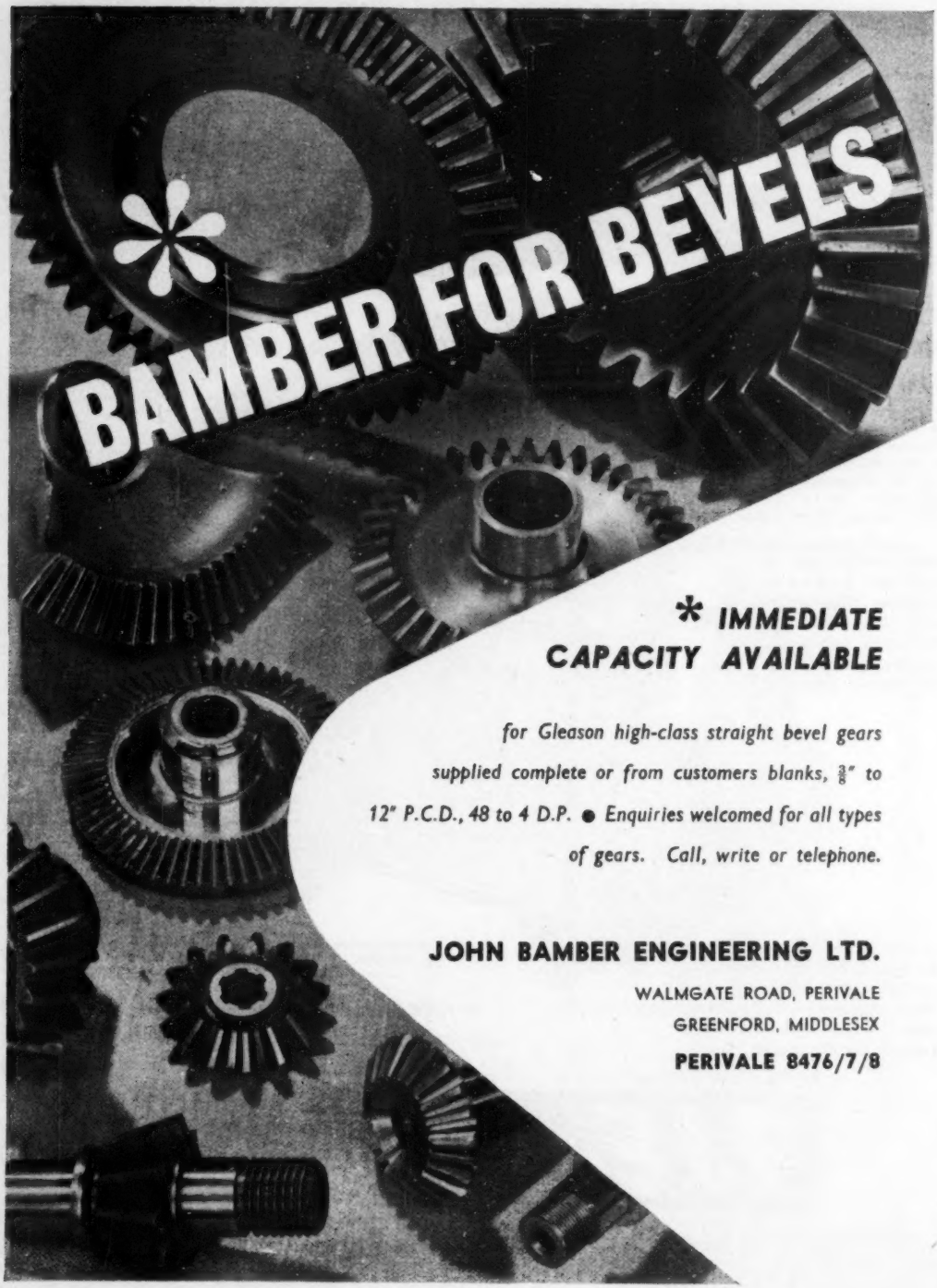
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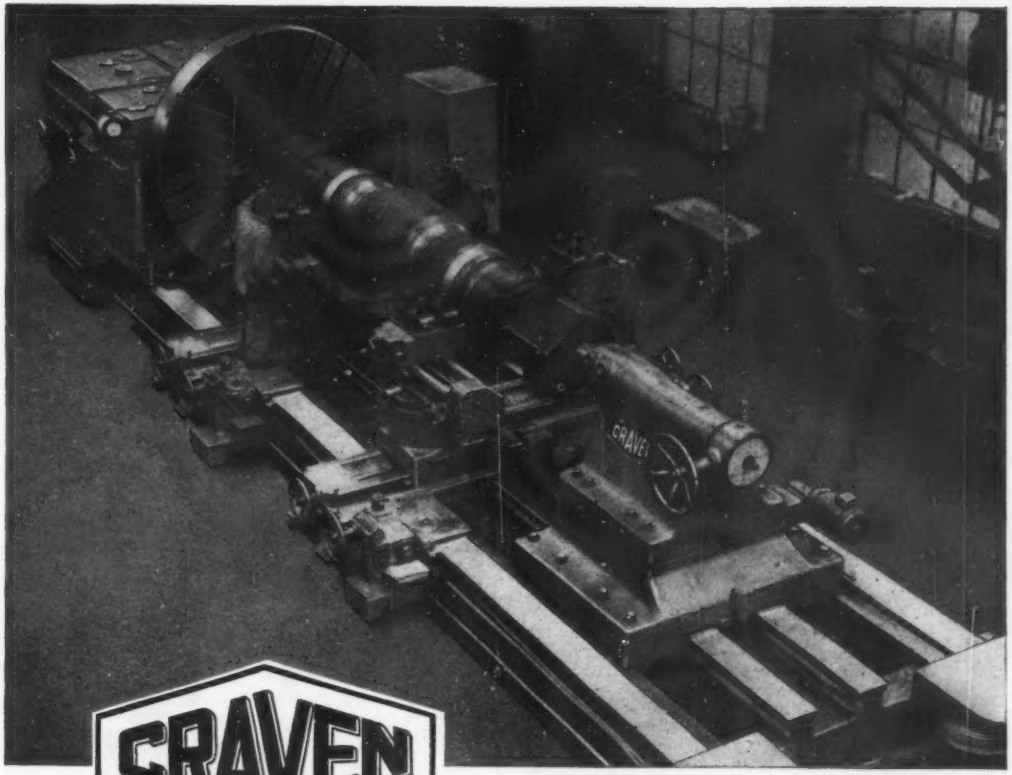
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48" Centres Sliding and Surfacing Crankshaft Lathe with interchangeable compound-type and lighthouse-type tool rests.

Heavy Duty Lathes for All Purposes

From 16in. to 100in. Height of Centres

There is a standard or special " Craven " Lathe for every large capacity or heavy duty turning requirement, a wide range of alternative arrangements being available to suit different classes of work. A speciality is made of heavy roll turning lathes and large diesel engine crankshaft lathes, whilst the " break " type of lathe construction is gaining popularity among marine engineers. The " Craven " range includes also high-speed tube boring machines and railway wheel and axle lathes of all types.

CRAVEN BROTHERS (MANCHESTER) LTD

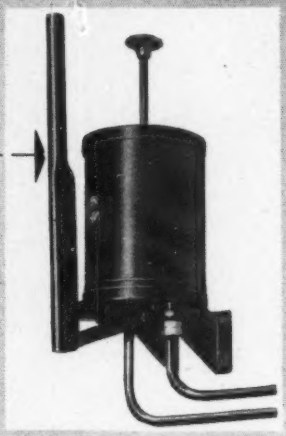
VAUXHALL WORKS · REDDISH · STOCKPORT · ENG

REMEMBER POPPY DAY

a new Tecalemit team for inexpensive, metered lubrication

* **The MINOR hand-operated pump**
* **The SINGLE-LINE grease injector**

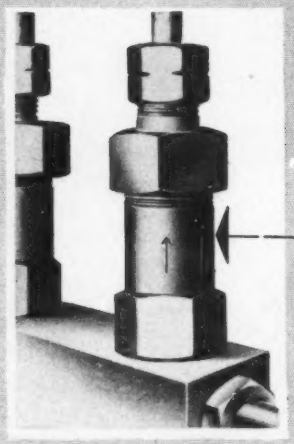
For consistently dependable, metered lubrication, these two new pieces of Tecalemit-engineered equipment make a perfectly matched team. Sturdily-designed and simply maintained, the MINOR pump will handle a wide range of lubricants whilst the SINGLE-LINE grease injector ensures positive barrel-to-bearing lubrication with up to 50% saving in grease.



The MINOR hand-operated pump

The MINOR hand-operated pump

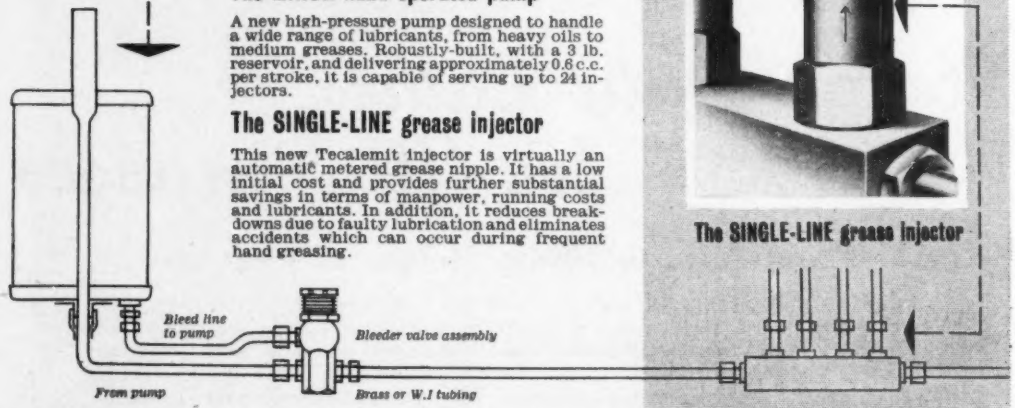
A new high-pressure pump designed to handle a wide range of lubricants, from heavy oils to medium greases. Robustly-built, with a 3 lb. reservoir, and delivering approximately 0.6 c.c. per stroke, it is capable of serving up to 24 injectors.



The SINGLE-LINE grease injector

The SINGLE-LINE grease injector

This new Tecalemit injector is virtually an automatic metered grease nipple. It has a low initial cost and provides further substantial savings in terms of manpower, running costs and lubricants. In addition, it reduces breakdowns due to faulty lubrication and eliminates accidents which can occur during frequent hand greasing.



VISIT TECALEMIT AT THE MOTOR SHOW ON STANDS 512 & 412.

TECALEMIT
The Authority on Lubrication

- THE MINOR PUMP WILL WORK IN CONJUNCTION WITH ANY SYSTEM
- THE SINGLE-LINE GREASE INJECTOR CAN ALSO BE OPERATED WITH SEMI-AUTOMATIC, FULLY-AUTOMATIC AND INTERMITTENT AUTOMATIC SYSTEMS

TECALEMIT (SALES) LTD PLYMOUTH DEVON

FULL DETAILS AND TECHNICAL INFORMATION FREELY AVAILABLE

T659B

8 machines in one!

THE COMPLETE TOOLROOM MACHINE

JIG BORING
DIESINKING
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HORIZONTAL MILLING
* **VERTICAL MILLING**
* **UNIVERSAL MILLING**
* **SLOTTING**
* **SHAPING**



With the VICTORIA 01 or 02 OMNIMIL

*and standard attachments * as used with your Victoria U1 and U2 Universal millers.*

01—40" x 11" table, power longitudinal table feed, 3 h.p. spindle motor.

02—45" x 11" table, power feed to all table movements, 4 h.p. spindle motor.

OPTICAL MEASURING EQUIPMENT as illustrated or dial gauges and measuring rod troughs available as extra equipment.

VICTORIA OMNIMIL

12 horizontal spindle speeds 31-1010 r.p.m. : 18 table feeds 0.4-12.25 in./min. : 8 vertical spindle speeds 80-2700 r.p.m : 3 power feeds .0015", .003" and .006" with auto trip : coarse and micrometer hand feed.

Write NOW for 44-page Machine Tool Catalogue

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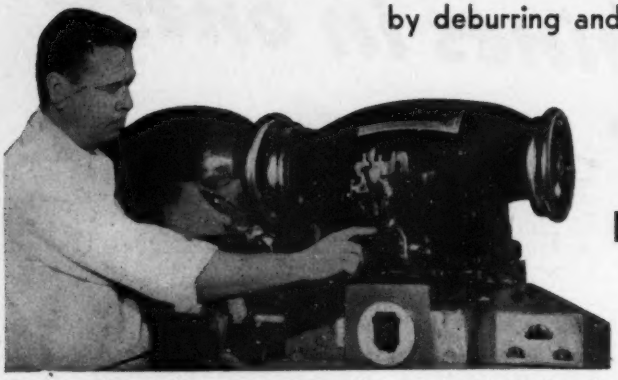
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DEVELOPMENT ENGINEER AT LANDIS MACHINE CO. REPORTS . . .

"We cut costs from £20 to 4/- per 100"

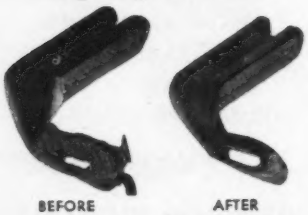
by deburring and finishing needle plates with



Mr. James W. Dunford, development engineer at Landis Machine Co. points to location of needle plate in new model of Landis shoe repair machine.

ALMCO

Barrel Finishing Equipment



BEFORE AFTER

One of the most successful barrel finishing applications on record at Almco is this needle plate deburring and finishing at Landis Machine Company.

The needle plate forgings are drilled and broached and then carefully deburred and finished. Formerly the cost of finishing and removing the tough burrs by hand filing was £20 per 100.

Now, an Almco Model DB-200 barrel finishing machine performs the same operation at a cost of 4/- per 100, a savings of 99%!

VERSATILE EQUIPMENT

By keeping simple records on processing cycles, correct media and compound, and proper scheduling, Landis engineers can switch the Almco equipment from part to part, to meet plant production requirements exactly.

BROAD EXPERIENCE FOR YOU

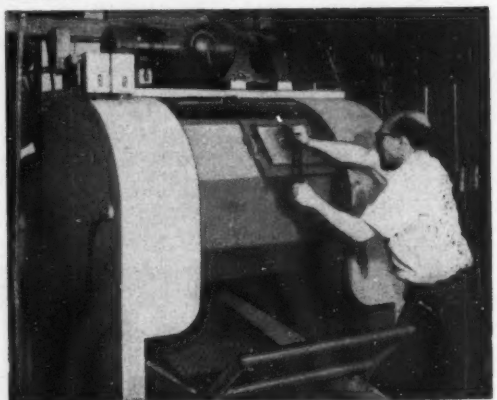
Almco's experience in barrel finishing methods and techniques now covers a wide range of parts, sizes, shapes, metals, and operations. Almco maintains sample processing laboratories for the purpose of analysing product parts and desired results. Let Almco technicians work out procedures to give you the quality you want at the lowest possible finishing cost.

REQUEST YOUR REPORT

Simply write on your company letterhead, requesting an Almco engineer to call on you. Or, send your sample parts and specifications on results direct to Almco. You will receive a detailed report at no obligation.

MANY LANDIS PARTS NOW BARREL FINISHED

With this £1,143 annual saving on needle plates alone in mind, Landis engineers have applied the Almco method to other parts until the company is now barrel finishing several hundred different parts to high quality standards. Rejects are practically non-existent.



Finishing department operator at Landis Machine Co. gets ready for parts deburring run in Almco barrel finishing machine. Almco construction is heavy-duty throughout, to stand up under rugged requirements month after month.

ALMCO Supersheen BURY MEAD WORKS · HITCHIN · HERTS

Telephone: Hitchin 3669

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STUDENT
6" × 24" Safety Lathe
Including full Electrical Equipment **Only £349**

CHIPMASTER
5" × 20" High Speed Precision Lathe
Including full Electrical Equipment **Only £320**

Also Available
MASTER 6½" × 36" All Geared Lathe
TRIUMPH 7½" × 30" & 48" Heavy Duty Lathe
MASCOT 8½" × 54" & 78" All Geared Lathe

Inspect these and other machines in our showrooms.

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MACHINE TOOL CO. LTD

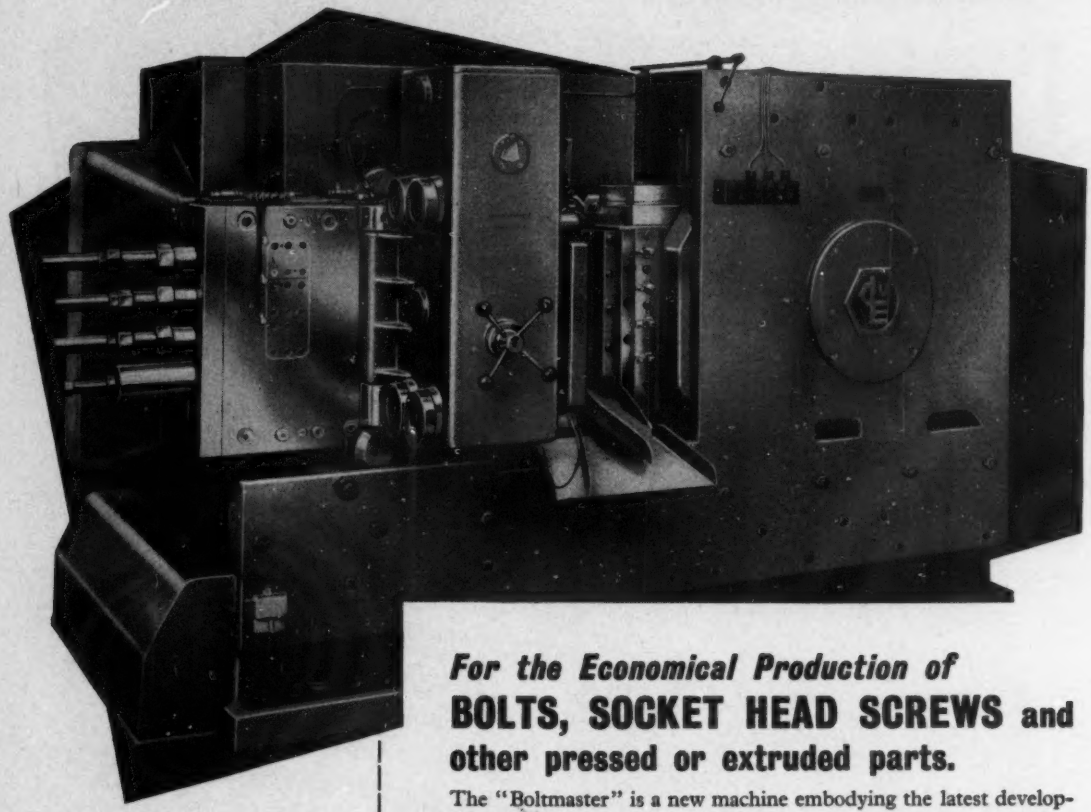
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The "Boltmaster" is a new machine embodying the latest developments in cold-forming techniques. It will pay you to investigate the possibilities of this machine.

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GB 300	up to 1 inch	50—80

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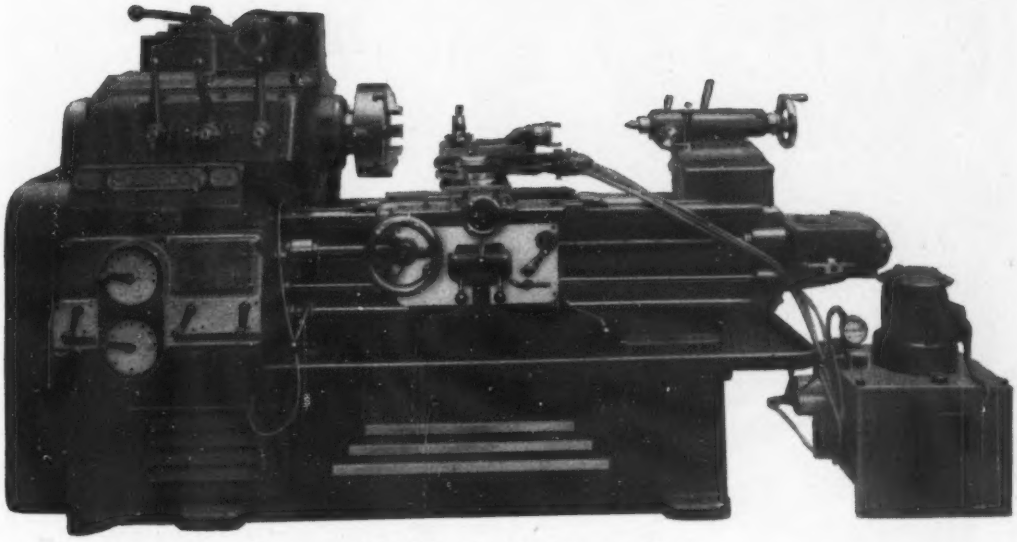
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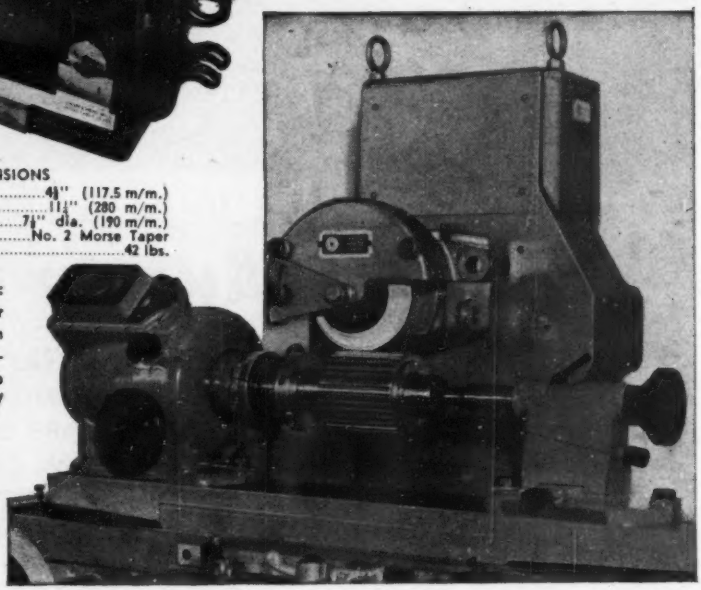
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COMBINING HIGHEST PRECISION WITH ROBUST CONSTRUCTION

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Size of Face Plates	7½" dia. (190 m/m.)
Size of Centres	No. 2 Morse Taper
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Combining the following features: Dead centre, adjustable drive for zero settings, large vernier screen reading direct to 6 secs. (estimation 3 secs.) and conforms to N.P.L. Specification MOY/SCMI/56. Patent 599708.



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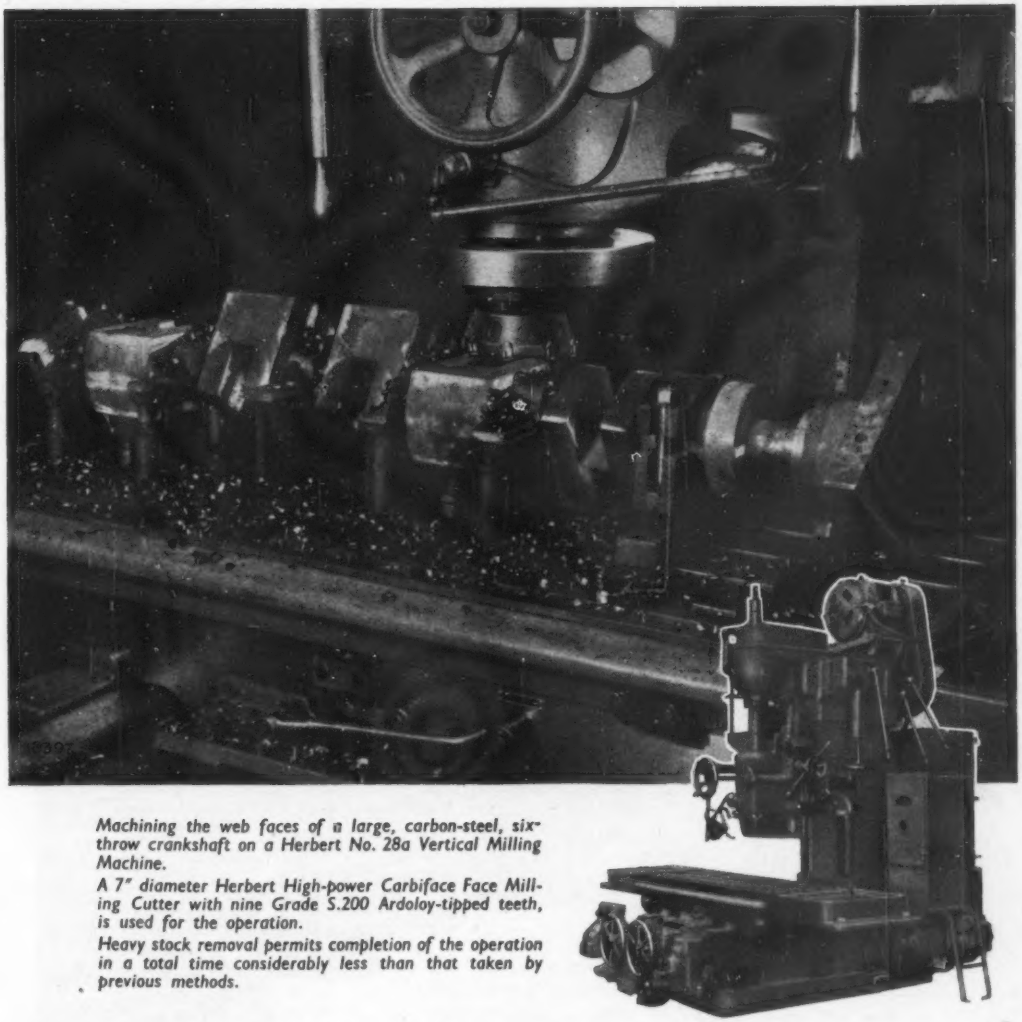
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For many years, Harpers have continued to supply these castings and during that time, over 10,000 have been made without a single reject on the part of the customer.

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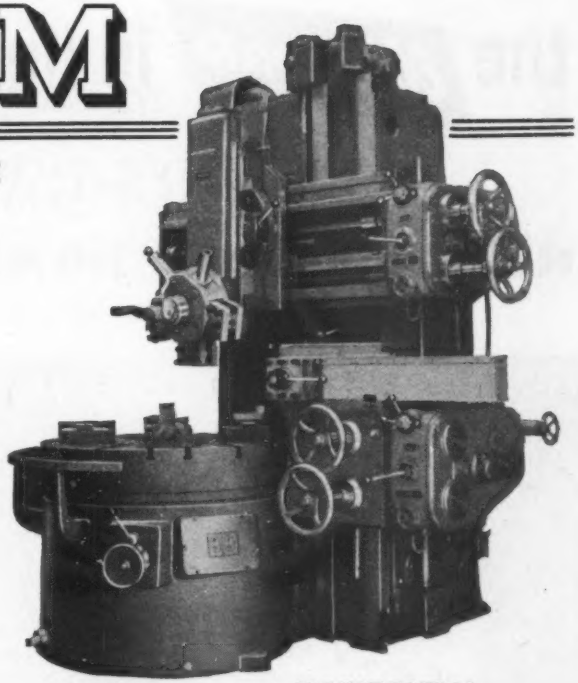

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Feeds to tool heads (12) 0.008"-0.394" per rev.



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IMMEDIATE DELIVERY

MODELS CWC 80 & HWC
EARLY DELIVERY



Model CWC 80

HORIZONTAL BORING & MILLING MACHINES CWC 80 & HWC

- Independent drive to spindle and facing head
- Hand and power drive to rotary table
- Heavy duty facing head

SPECIFICATION	CWC 80	HWC
Spindle diameter ...	3"	4 5/8"
Maximum facing diameter	36"	49"
Maximum boring depth	28"	33"
Table	35" x 44"	47" x 55"
Table feeds:		
Longitudinal	39"	61"
Cross	32"	47"
Spindle speeds	(15) 15-515	(18) 8½-562

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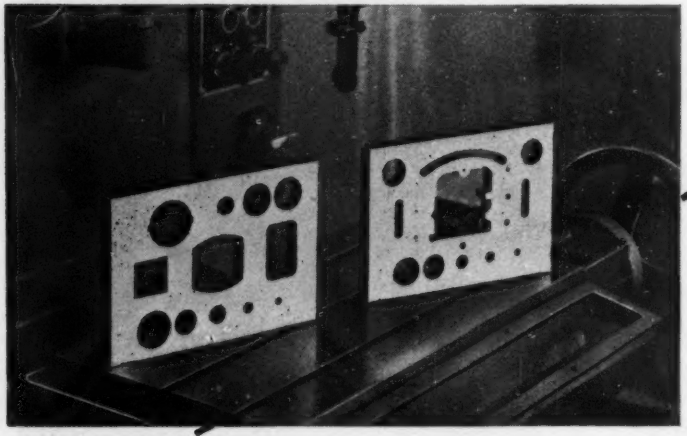
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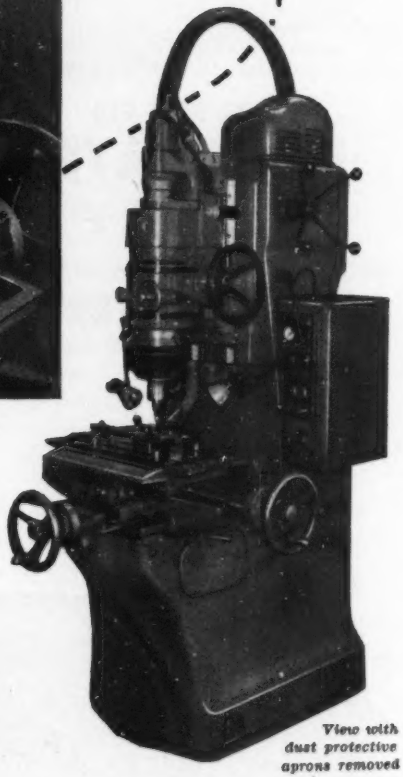
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CONTOURS
regular and irregular, straight or tapered
Especially suitable for the production of accurate press tools; Table size 10" x 19"

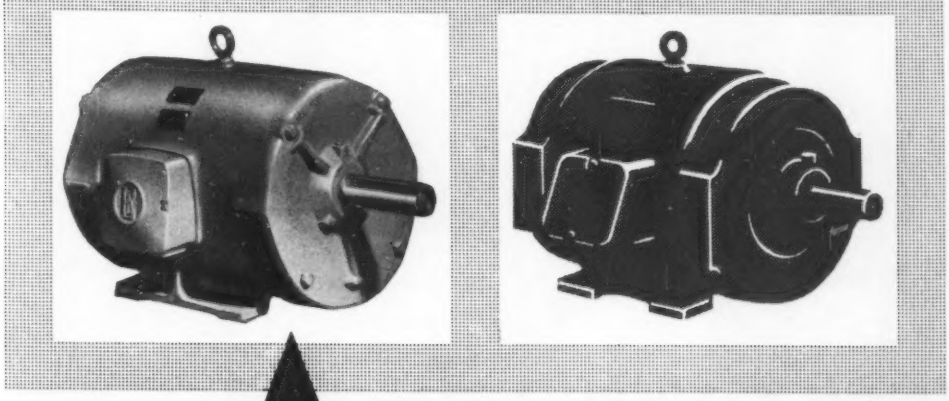
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NRP 1440

same size—same weight



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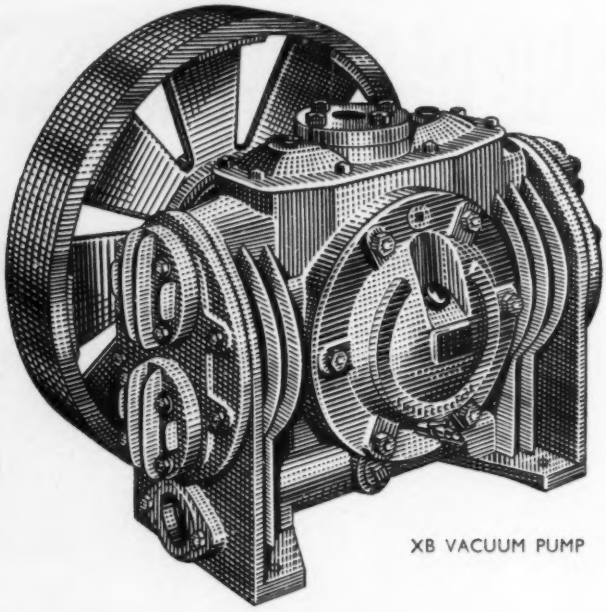
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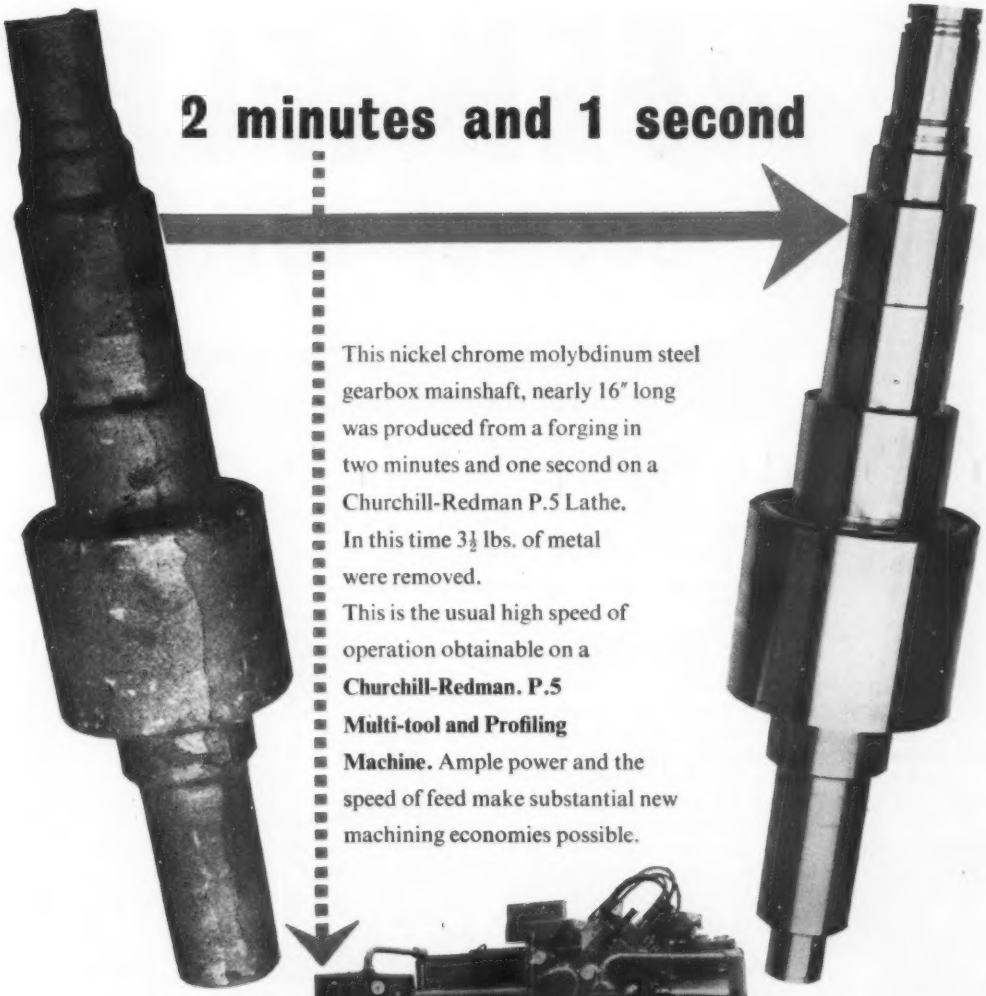
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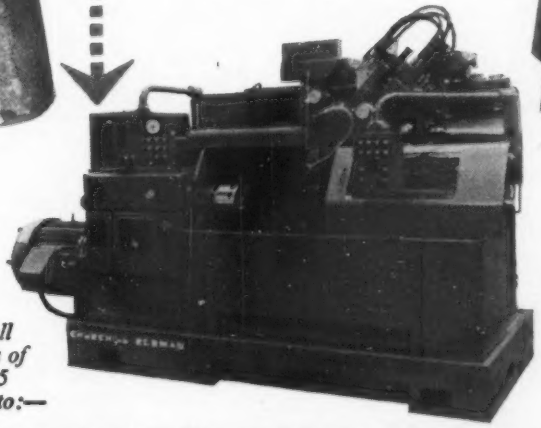
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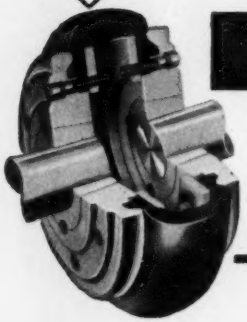
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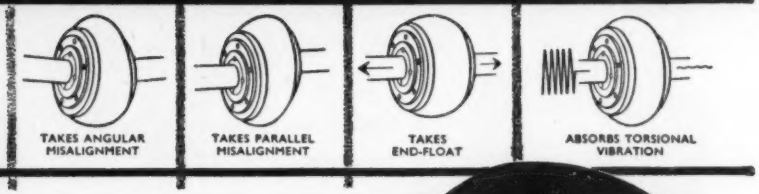
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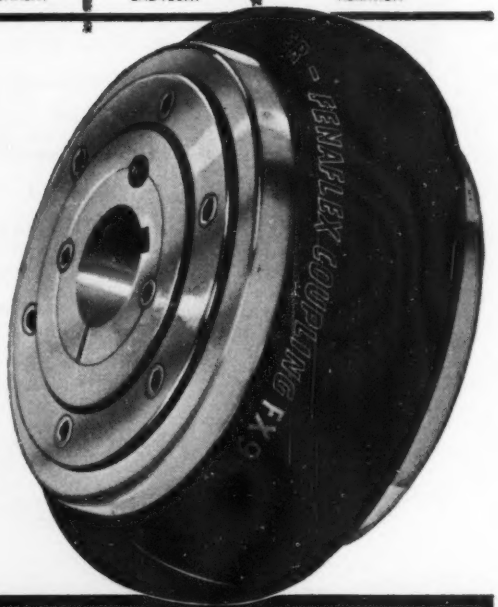
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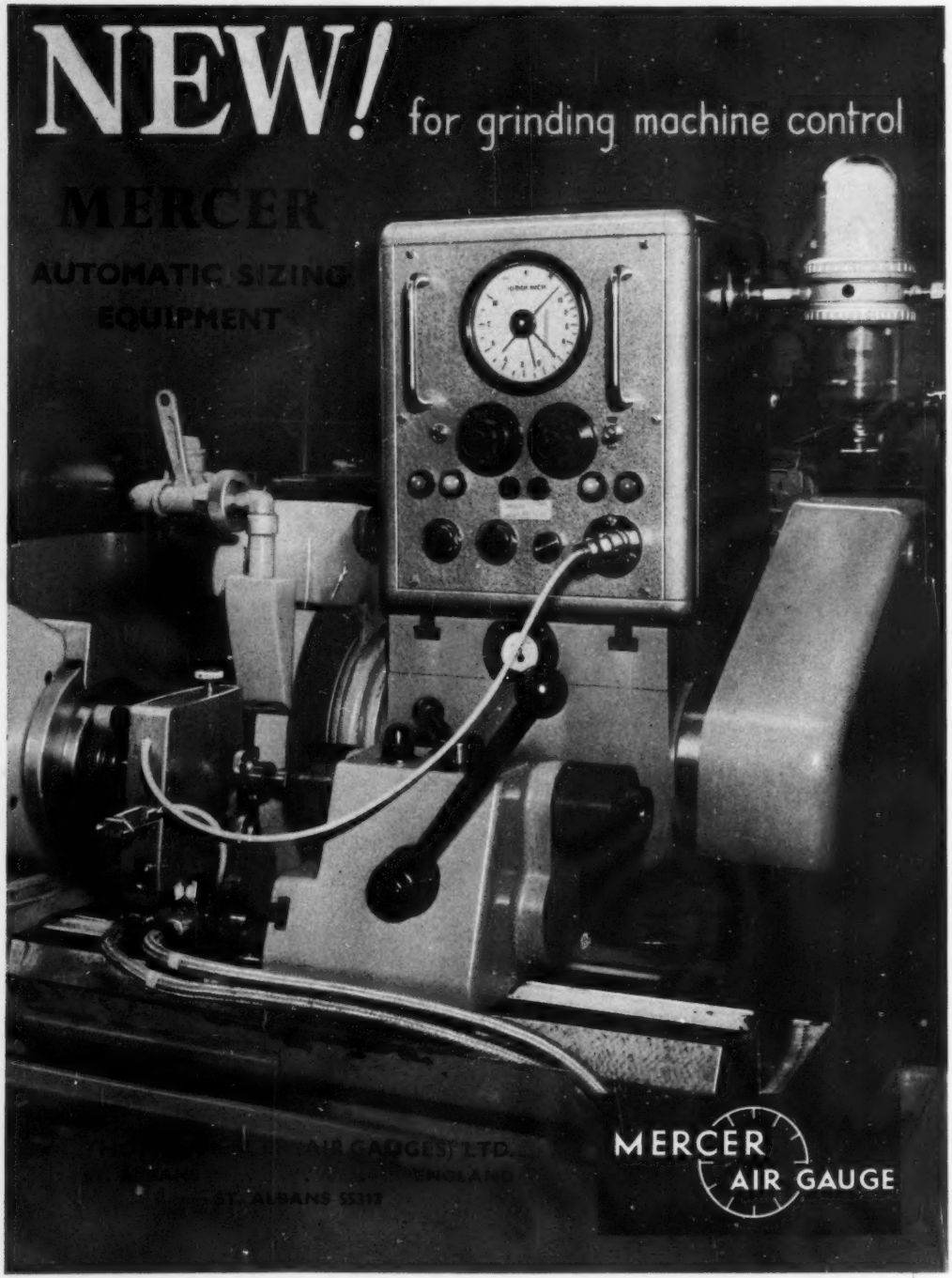
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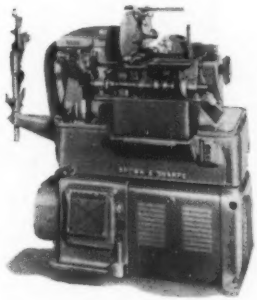
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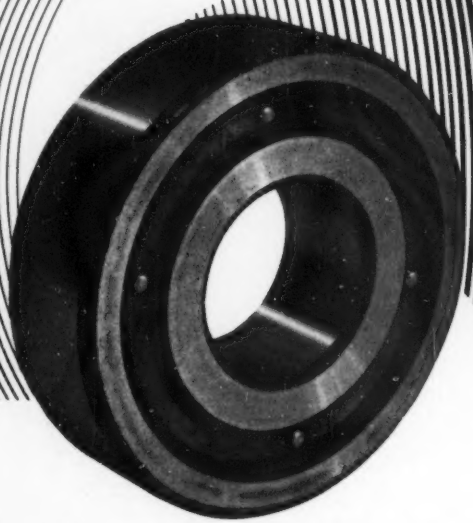
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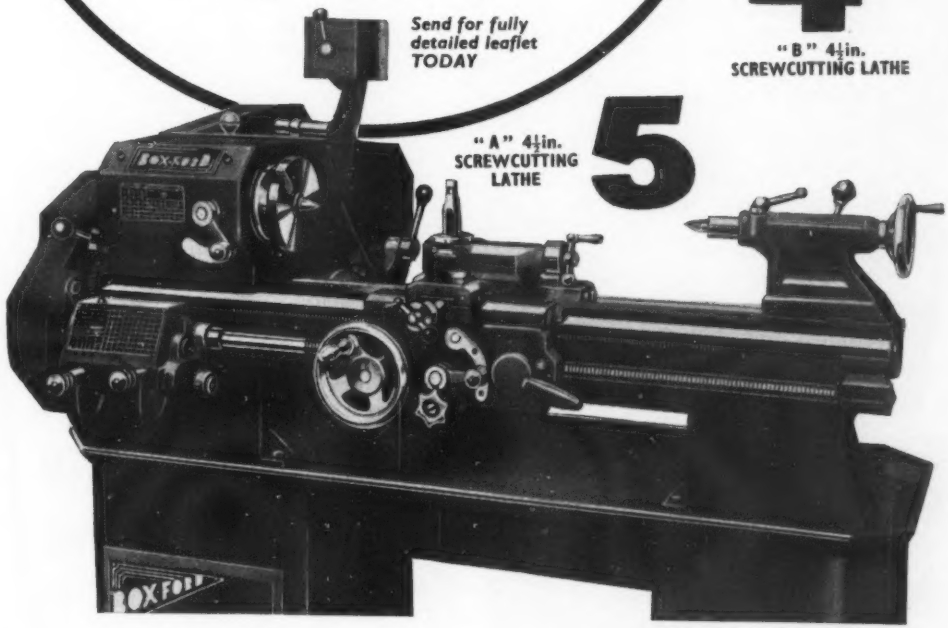
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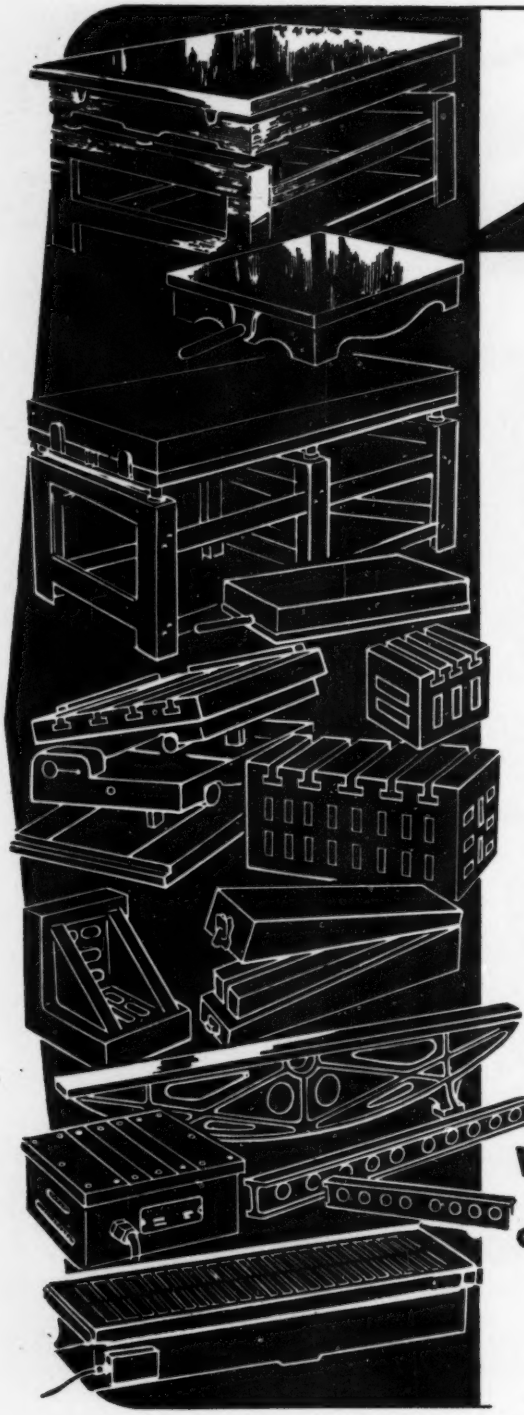
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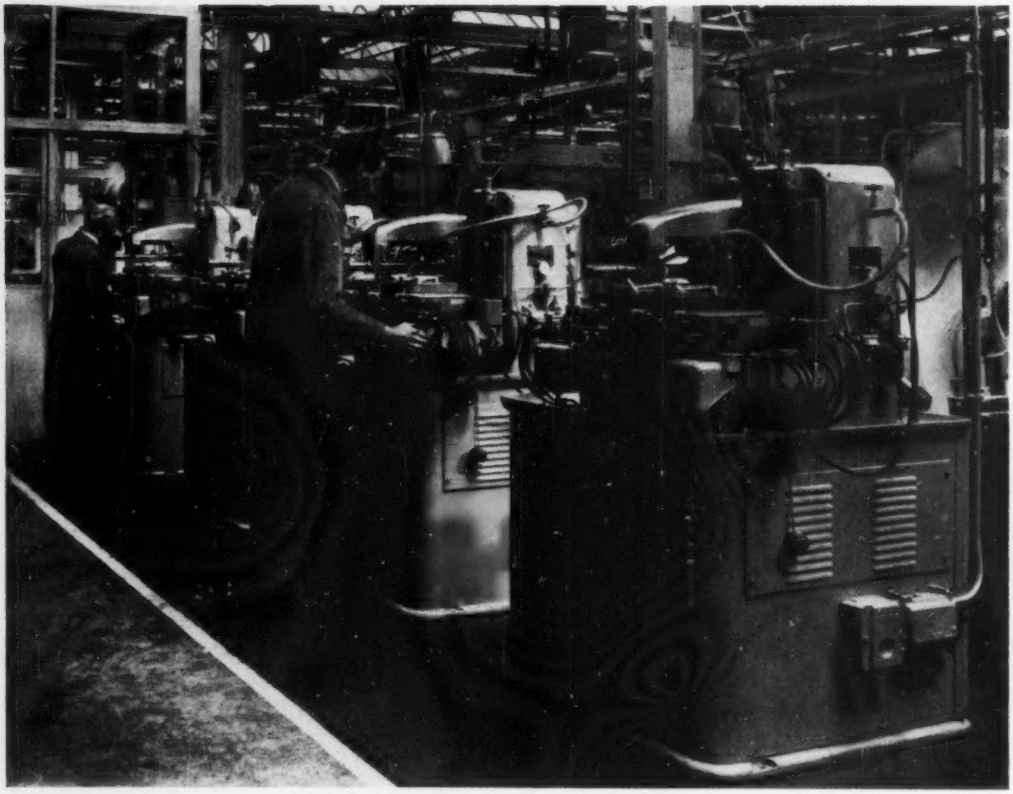
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PROGRAMME CONTROLLED

Automatic Milling Machines

for consecutive operations in automatic sequence
are used by ROLLS ROYCE at their aero-engine factory at Derby.



Four of a batch of eight machines, each operator works two machines.

Photograph by courtesy of Rolls Royce Ltd., Derby

CENTEC MACHINE TOOLS LIMITED · CENTEC WORKS · HEMEL HEMPSTEAD · HERTS · *Boxmoor 584-5-6*

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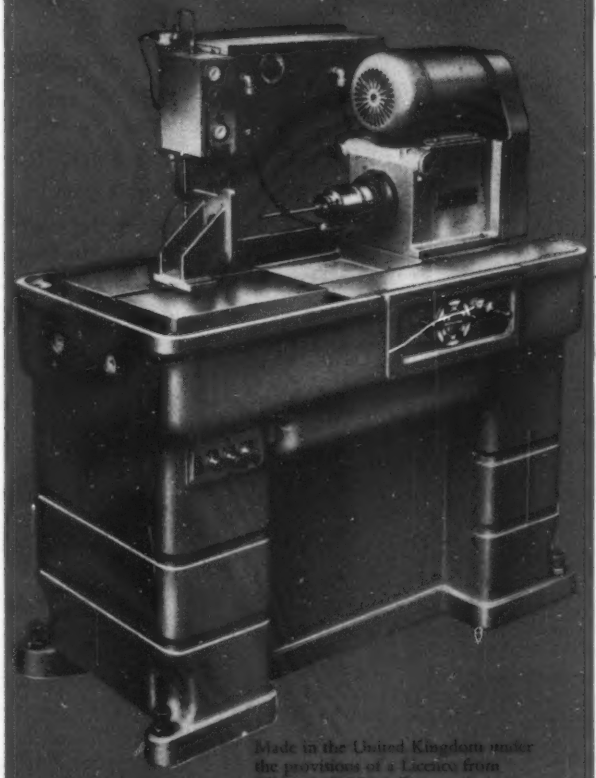
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A NEW

JONES-SHIPMAN

BRITISH HONING MACHINE

MODEL 150 HYDROHONER



Made in the United Kingdom under the provisions of a Licence from Microwatic Hone Corporation, Detroit, Michigan, U.S.A.

A. A. JONES & SHIPMAN LTD.

Narborough Road South, Leicester.
Tel.: 82522. Telegrams: 'Chuck' Leicester.
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REAL HONER

a 4 stage machine equally for BATCH and HIGH PRODUCTION WORK

The "150" is designed to fill the gap between the large mass producer and the smaller shop. It is available as a basic machine, the other stages leading to full automation can be added whenever desired. The machine has a maximum stroke of 12in. and a work capacity up to 1½in. dia.

BASIC to AUTOMATION

Stage 1
Basic machine with manual tool feed expansion.

Stage 2
Automatic hydraulic feed control and stonewear compensation.

Stage 3
Automatic sizing.

Stage 4
Automatic work handling.

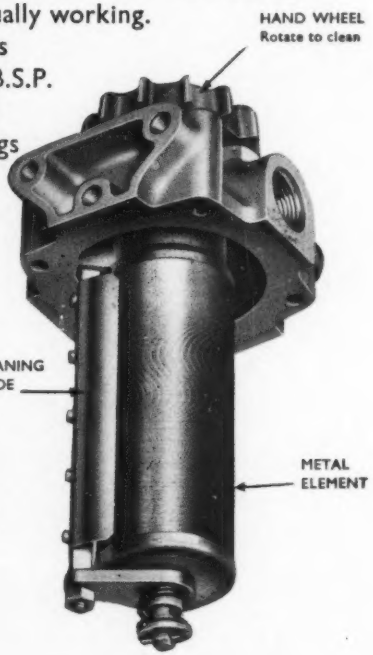
SERVICE—*Jones-Shipman Field Engineers always prove this Honer in your Works. Your interests in both practical and economic performance are their job.*

Refer to Machinery, October 8th, 15th and 22nd for details of other Jones-Shipman Honing Machines.



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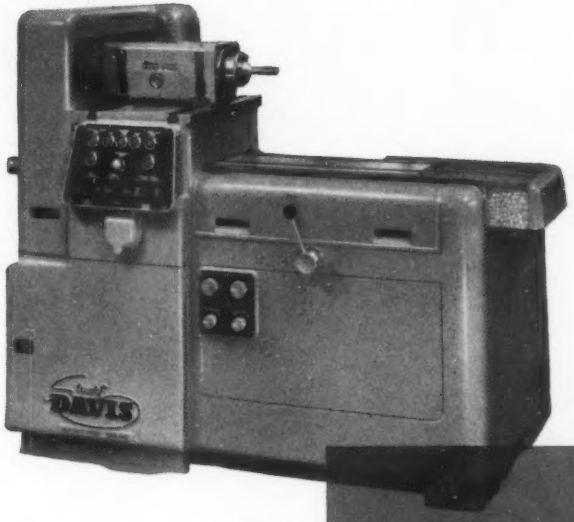
These filters incorporate the Purolator precision-wound metal element which presents a series of knife-edged orifices to the incoming fluid. This ensures that all arrested contaminant remains on the outer surface of the element so that it can easily be cleaned off. The type shown here is fitted with a mechanical cleaning device which will remove dirt from the element whilst it is actually working. A range of sizes from $\frac{3}{8}$" to 2" B.S.P. is available and element spacings from ·002" to ·020" can be provided.



PUROLATOR

Regd. Trade Mark: Purolator

AUTOMOTIVE PRODUCTS COMPANY LIMITED
LEAMINGTON SPA, WARWICKSHIRE, ENGLAND





This Fine Boring Machine makes good use of Keelavite hydraulics. It is made by Stuart Davis Ltd, of Coventry.

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We at Keelavite are a team of experts in the design, installation and maintenance of complete hydraulic systems. We are ready to accept full responsibility for the proper working of all our installations, including all electrical or other control equipment.

Not only this, we are the manufacturers of the largest range of hydraulic units in the United Kingdom.

We are, of course, fully experienced in special applications of hydraulic power for the machine tool industry.

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Hydraulics
MACHINE TOOL DIVISION

THE RECOGNISED AUTHORITY

KEELAVITE ROTARY PUMPS & MOTORS LTD.
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583

AMERICAN STANDARD CAMLOCK SPINDLE FLANGE.....

Dean Smith & Grace
KEIGHLEY LIMITED ENGLAND
TELEPHONE: KEIGHLEY 5261 (7 LINES) TELEX No. 51-123



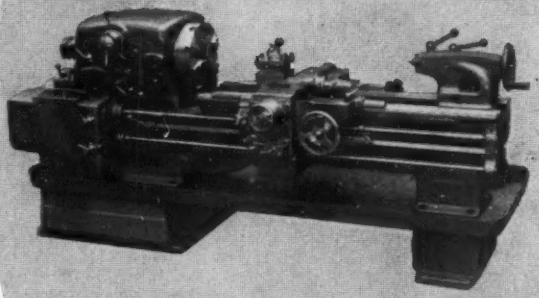
...featured on all D.S.G. lathes

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- INTERCHANGEABILITY
- RIGID MOUNTING
- RAPID CHANGING

17" swing ENGINE LATHE

Note the spindle bore size, and oversize Camlock flange on these types:

13" swing	D1-6"	1⅝" hole
17" swing	D1-8"	2⅛" hole
21" swing	D1-11"	3⅝" hole
25" swing	D1-11"	4⅛" hole
30" swing	D1-11"	4⅝" hole

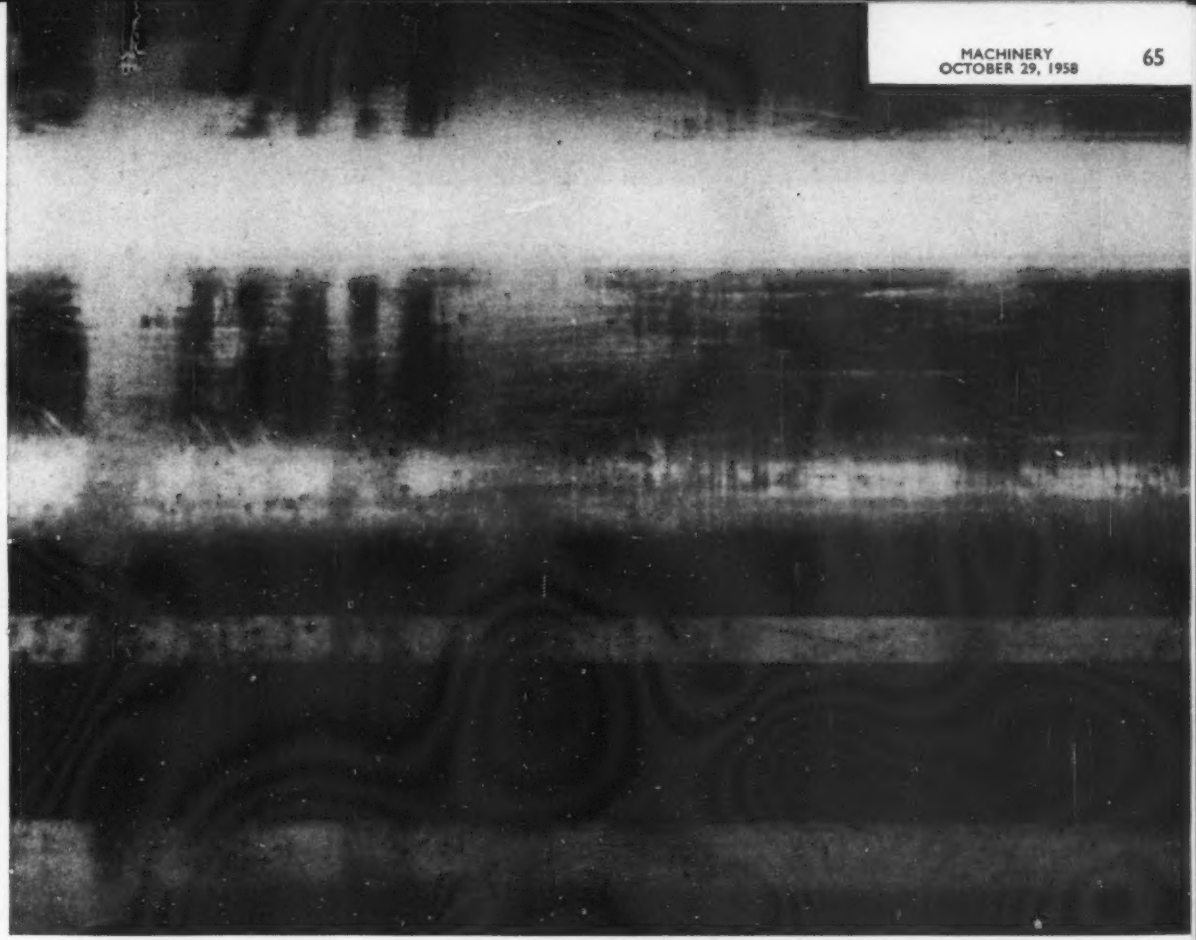


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13" to 30" SWING ENGINE LATHES
SURFACING AND BORING LATHES
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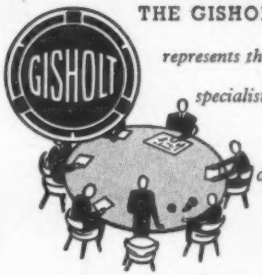
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The main bearing of this small crankshaft was originally finished by a mechanical sanding machine. Then it was partially Superfinished — just enough to reveal the lack of adequate bearing capacity. Light abraded areas are the only true geometrical surfaces. Dark areas are low spots which carry no bearing load. The area contact of the superfinishing stone brings out deficiencies in production which were never intended by the designing engineer.

For more information on Superfinishing, write to our agents who will give you full details of Gisholt British built Superfinishers.



THE GISHOLT ROUND TABLE

represents the collective experience of specialists in machining, surface-finishing and balancing of round & partly round parts. Your problems are welcomed here.

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All enquiries to the sole concessionaires in Great Britain :

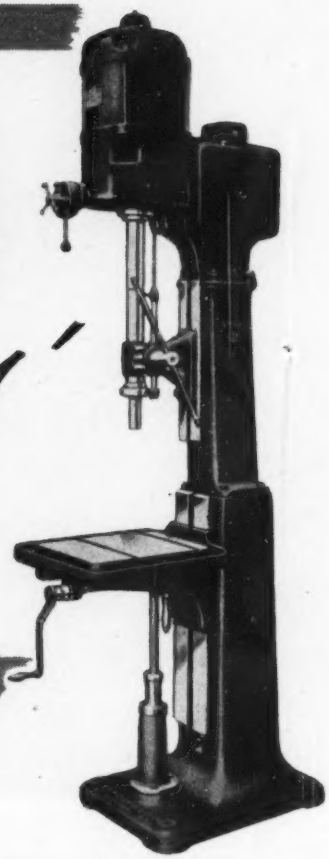
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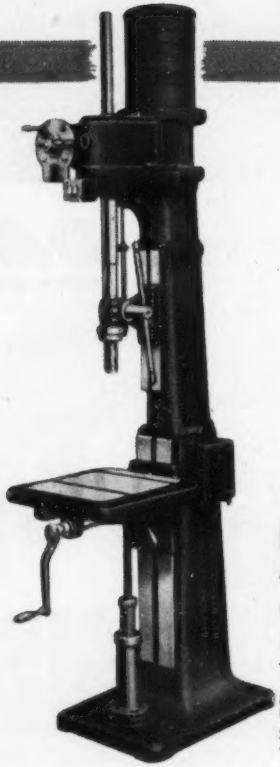
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'Sensitives'

FOR EVERY NEED





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ALL GEARED DRIVE
SINGLE OR NINE-SPEED GEARBOX
15" SWING
1" CAPACITY IN MILD STEEL

MODEL 15 AX

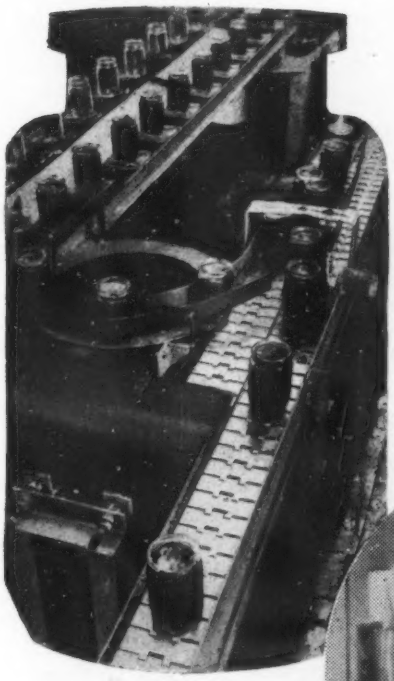
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4 OR 8 SPEEDS
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BOTH MODELS AVAILABLE IN SMALLER CAPACITY FOR WORK UP TO $\frac{5}{8}$" IN M.S.

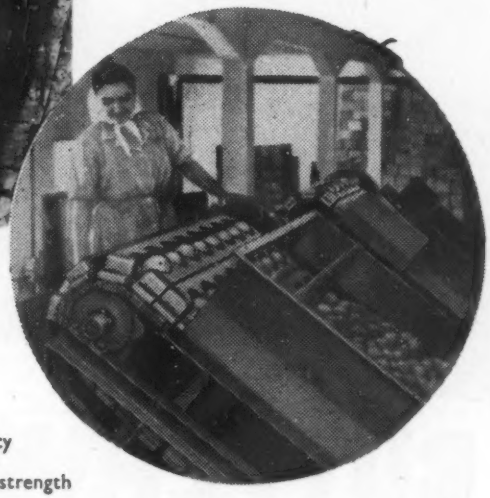
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TEL: LEICESTER 67534 (5 lines)

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from Jam to Oranges



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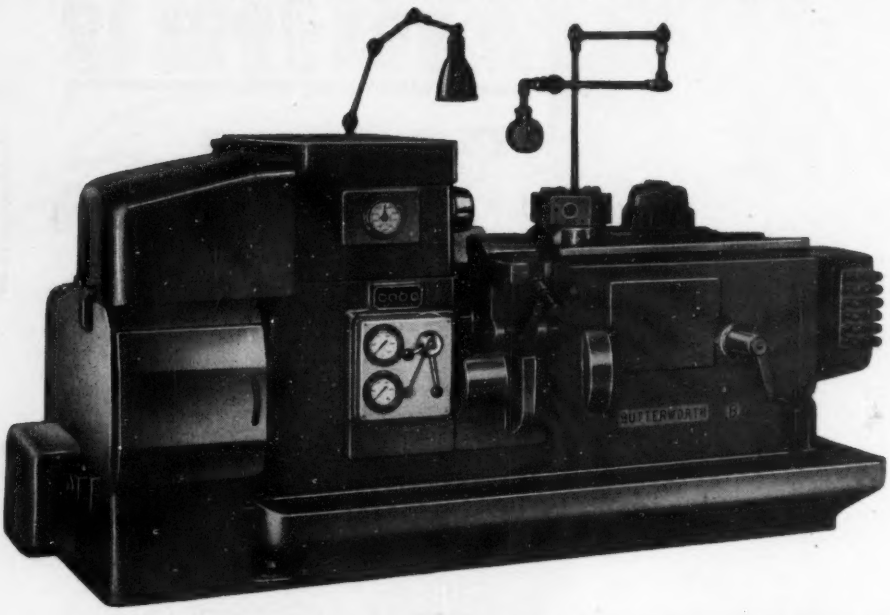
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RENOLD — *the FIRST name in precision chain*

RENOLD CHAINS LIMITED · MANCHESTER
1739

UNSURPASSED PRODUCTION CAPACITY

★ *ON SHORT OR LONG RUNS*



BUTTERWORTH

HYDRAULIC AUTOMATIC

★ *FOR BAR AND CHUCK WORK*

The many outstanding features of this machine ensure faster cycle time and lower costs per piece . . . even on short runs. No special cams are needed and the exceptionally wide speed range covers all materials, from light alloys to high tensile steels. Hydraulic feed control. Hydraulic chucking. Hydraulic bar feed.

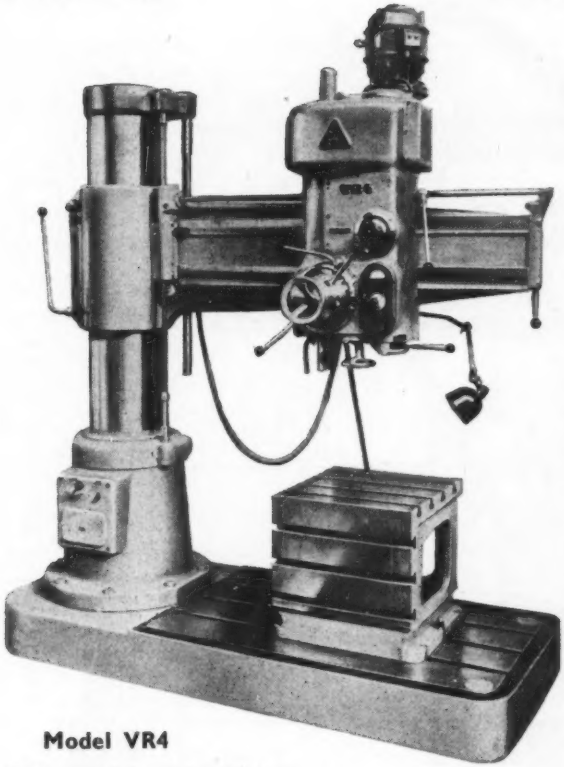
Three sizes, with capacity for rounds of 1⅝in., 2in. and 2¼in. respectively.

Hydraulic copy turning attachment and cross slide longitudinal turning attachment available.

Other sizes and models available include: ⅞in. SD, ⅞in. to 1 1/16in. SD, 1¼in. AG, 3in. AG and 3¼in. AG.

Write for catalogue.

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BRITISH AUTOMATIC MACHINE TOOL CO. LTD.
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Model VR4

Other models early delivery

MAS

Radial DRILLING MACHINES

Consider these features:

- ★ Simplified and easy operation.
- ★ Patent locking of arm on column.
- ★ Single lever locks arm and head.
- ★ Drilling speeds selected and engaged by single lever.
- ★ Automatic disengagement of power feed at required depth.
- ★ Automatic lubrication of drilling head.

MODELS VR2 & VR4 IMMEDIATE DELIVERY

SPECIFICATION	VR2	VR4	VR6	VR8
Drilling Capacity in Steel	1in.	1¼in.	2¼in.	3¼in.
Drilling Capacity in Cast Iron	1¼in.	2in.	3¼in.	4¼in.
Maximum distance centre line of spindle to column	31¼in.	49in.	79in.	99 in.
Minimum distance centre line of spindle to column	9in.	12¼in.	17in.	19¼in.
Maximum distance spindle nose to Box table	24in.	30in.	52in.	64in.
Maximum distance spindle nose to base	40in.	51in.	72in.	83in.
Vertical movement of arm on column	21in.	28in.	34in.	41¼in.
Taper in spindle	3 M.T.	4 M.T.	5 M.T.	6 M.T.
Spindle Speeds (12)	90-4,500	45-2,000	16-1,400	11-1,000
Spindle Feeds	(6) 85-850 cuts p. inch	(10) 16-1,020 cuts p. inch	(10) 13-820 cuts p. inch	(10) 11½-720 cuts p. inch

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'Biceps' mean smoother, quicker . . .

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(especially heavy sheet materials)



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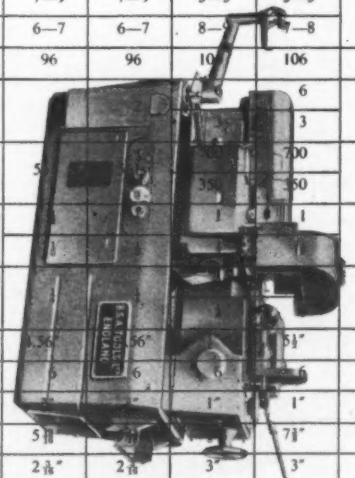
MACHINE		48	68	18L	25L	68L	88L	98L	138L	168L	METRIC 24	METRIC 36	METRIC 52
Workspindle capacity	round	¼"	⅜"	18 mm.	25 mm.	⅜"	1"	1¼"	1⅝"	2"	24 mm.	36 mm.	52 mm.
	square	.353"	¼"	13 mm.	18 mm.	.0530"	.0708"	⅝"	1¼"	1.414"	17 mm.	25.4 mm.	35 mm.
	hexagon	.437"	⅜"	16 mm.	22 mm.	0.650"	0.866"	⅞"	1⅛"	1.730"	20 mm.	30 mm.	45 mm.
Max feed in one movement	long stroke	2"	3"	75 mm.	75 mm.	3"	3"	4"	4"	4"	90 mm.	90 mm.	90 mm.
	short stroke	1"	2"			2"		2½"	2½"				
Stroke of turret cam (standard)		1⅜"	2¼"	50 mm.	50 mm.	2¼"	2¼	3"	3"	3"	80 mm.	80 mm.	80 mm.
Max. diameter using diehead		⅜" fine	⅜" fine	16 mm.	16 mm.	⅜" fine	⅜" fine	1"	1¼"	1¼"	18 mm.	18 mm.	18 mm.
Range of spindle speeds		166—7,370	53—4,480	40—4,500	40—4,500	53—4,480	53—4,480	70—3490 24—3590	78—2300 25—2540	69—1,520	38—3,000	24—1,900	30—1,500
Number of high speeds	4 speed	18	10	14	14	10	10	22	19	17	10	10	8
	2 speed			14	14	10	10	13	12				
Low speeds available for each high speed		2	10	11—13 9—10	11—13 9—10	7—9 6—7	7—9 6—7	3—5 8—[illegible]	3—5 —8	3—5	4—5	4—5	4—5
Number of cycle times		46	65	96	96	96	96	10[illegible]	106	106	46	46	46
Cycle time range (secs) fastest	long stroke	¾	2	2	2	[illegible]	[illegible]	[illegible] 6	[illegible] 6	6	8	8	8
	short stroke	¾						[illegible] 3	[illegible] 3				
slowest	long stroke	75	180	561	561	5[illegible]	[illegible]	[illegible] 700	[illegible] 700	700	360	360	360
	short stroke	56¼						35[illegible]	[illegible] 60				
Actual time to feed stock (secs)	long stroke	¼	¼	½	½	[illegible]	[illegible]	1	1	1	1	1	1
	short stroke	¼	¼			[illegible]	[illegible]	[illegible]	[illegible]				
Time to change speed (secs)	long stroke	½	½	½	½	[illegible]	[illegible]	[illegible]	[illegible]	½	½	½	½
	short stroke	½	½			[illegible]	[illegible]	[illegible]	[illegible]				
Diameter of turret		3⅜"	4 1/16"	116 mm.	116 mm.	3.50[illegible]	[illegible]6"	[illegible]	5½"	5½"	140 mm.	140 mm.	140 mm.
Number of turret holes		6	6	6	6	[illegible]	[illegible]	[illegible]	[illegible] 6	6	6	6	6
Diameter of turret holes		⅜"	½"	19.05 mm.	19.05 mm.	[illegible]	[illegible]	1"	1"	1"	25.4 mm.	25.4 mm.	25.4 mm.
Distance chuck to turre	max.	3⅜"	5⅛"	120 mm.	120 mm.	5[illegible]	[illegible]	[illegible]	7⅛"	7⅛"	180 mm.	180 mm.	180 mm.
	min.	1 1/16"	2⅛"	49 mm.	49 mm.	2 1/16"	2 1/16	3"	3"	3"	64 mm.	64 mm.	64 mm.
Turret slide adjustment		1/16"	½"	21 mm.	21 mm.	1 1/16"	1 1/16"	1½"	1½"	1½"	38.1 mm.	38.1 mm.	38.1 mm.
Spindle centre to top of cr[illegible]	slide	1"	1 1/16"	30 mm.	30 mm.	1 1/16"	1 1/16"	1 7/16"	1 7/16"	1 7/16"	36 mm.	36 mm.	36 mm.
Movement of cross slide		1"	1¼"	32 mm.	32 mm.	1¼"	1¼"	1½"	1½"	1½"	40 mm.	40 mm.	40 mm.

B·S·A

is offered by—

of single-spindle automatics

this wide range



capacities up to 2" or 52mm (round)

on TWELVE BASIC TYPES

there are several variations

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Strasmann Machine Reamers also manufactured from cobalt steel are designed for through hole reaming in all metals. Good finish, straight holes are possible at high production rates. Hole sizes are constant and regrinding does not affect the diameter.

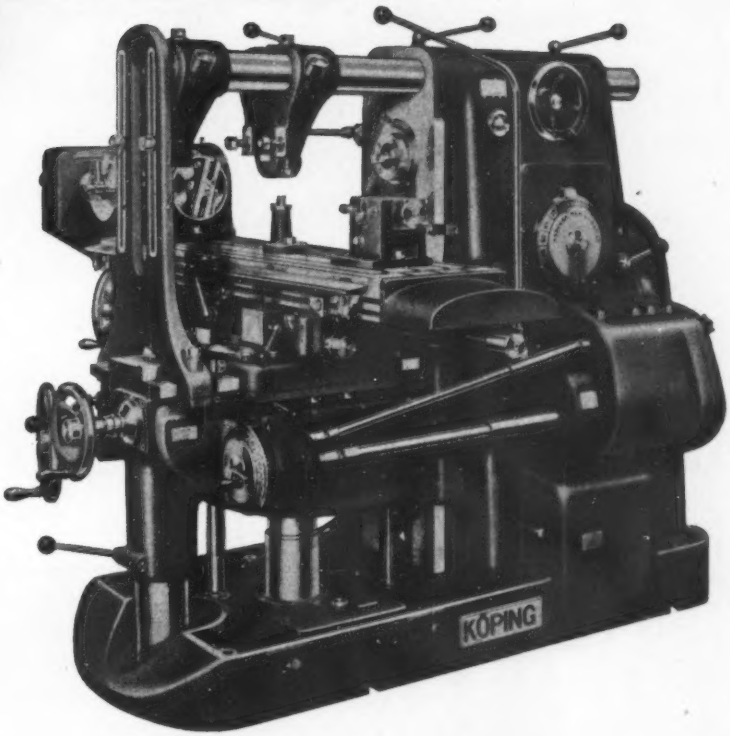


TEROY LTD

Sole distributors for Strasmann Roughing Cutters and Reamers in the U.K., would be pleased to send you literature and arrange a demonstration. Enquiries for special requirements are gladly invited.

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PORTS 33217/8

KÖPING HEAVY DUTY MILLING MACHINE Model UF2A



☆ Table 60in. by 14in.
13½h.p. Asea Motor
with power feeds
and rapid traverses
in all 3 TABLE
Directions
18 Spindle Speeds
up to 1,500 R.P.M.
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Feeds

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for all pneumatic applications

Catalogue on application to :

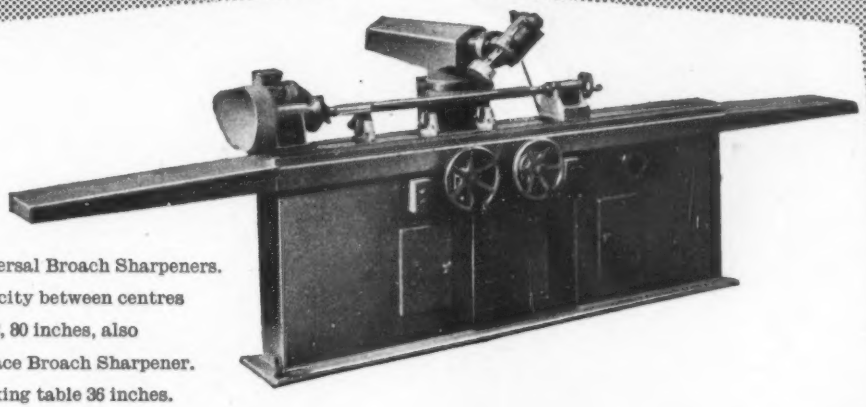
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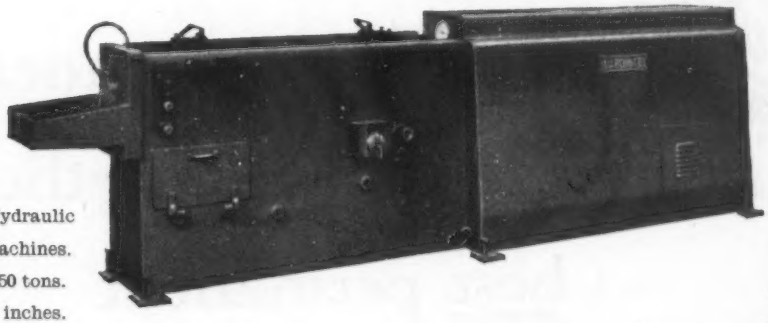
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Capacity between centres
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Surface Broach Sharpener.
Working table 36 inches.



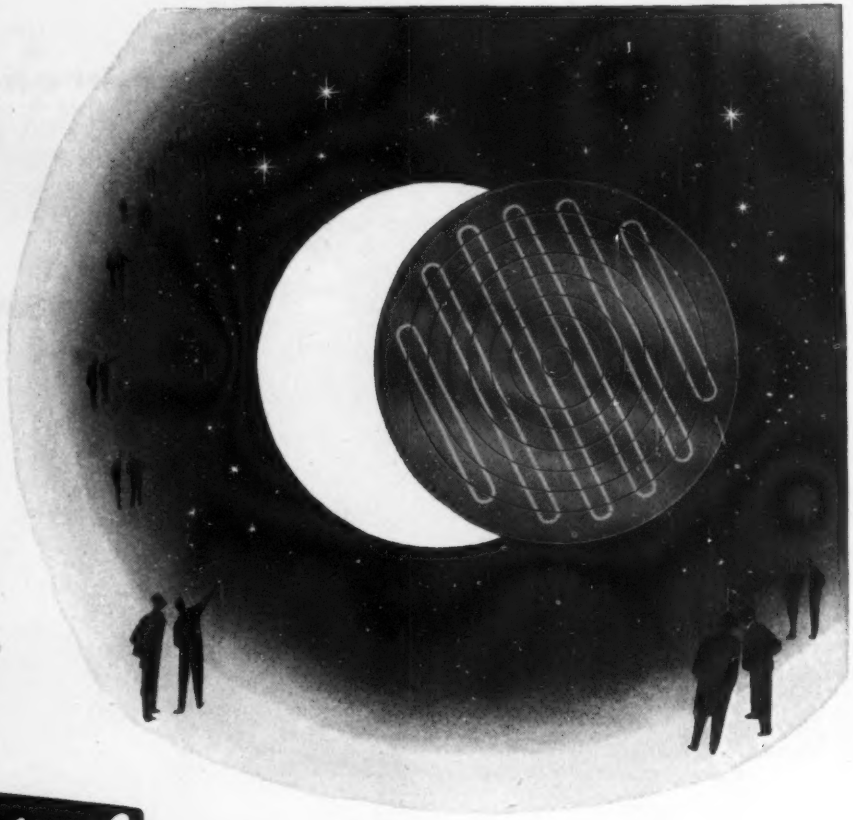
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Stroke: 30-78 inches.

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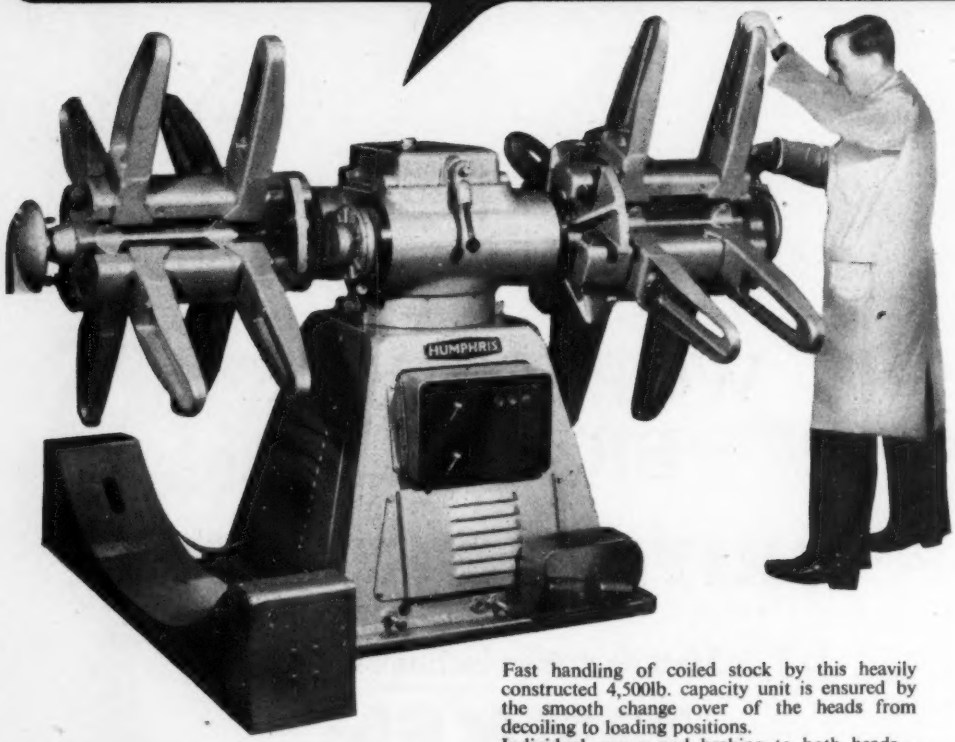
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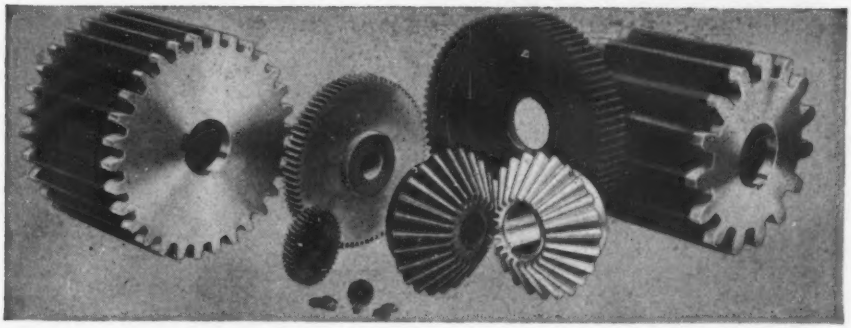


Fast handling of coiled stock by this heavily constructed 4,500lb. capacity unit is ensured by the smooth change over of the heads from decoiling to loading positions.
Individual power and braking to both heads—photo electric cell system of loop control.

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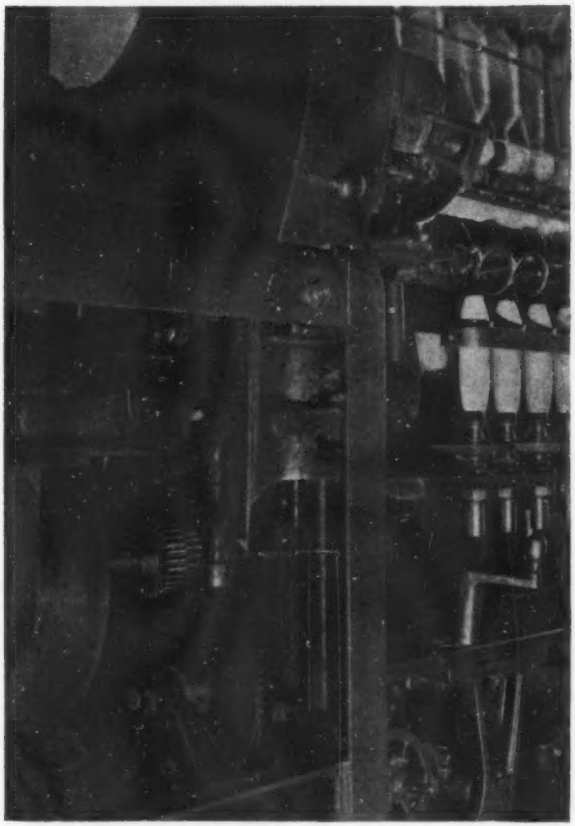
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Right wheel



for quieter drives

TUFNOL gear wheel driving tin roller on ring spinning frame



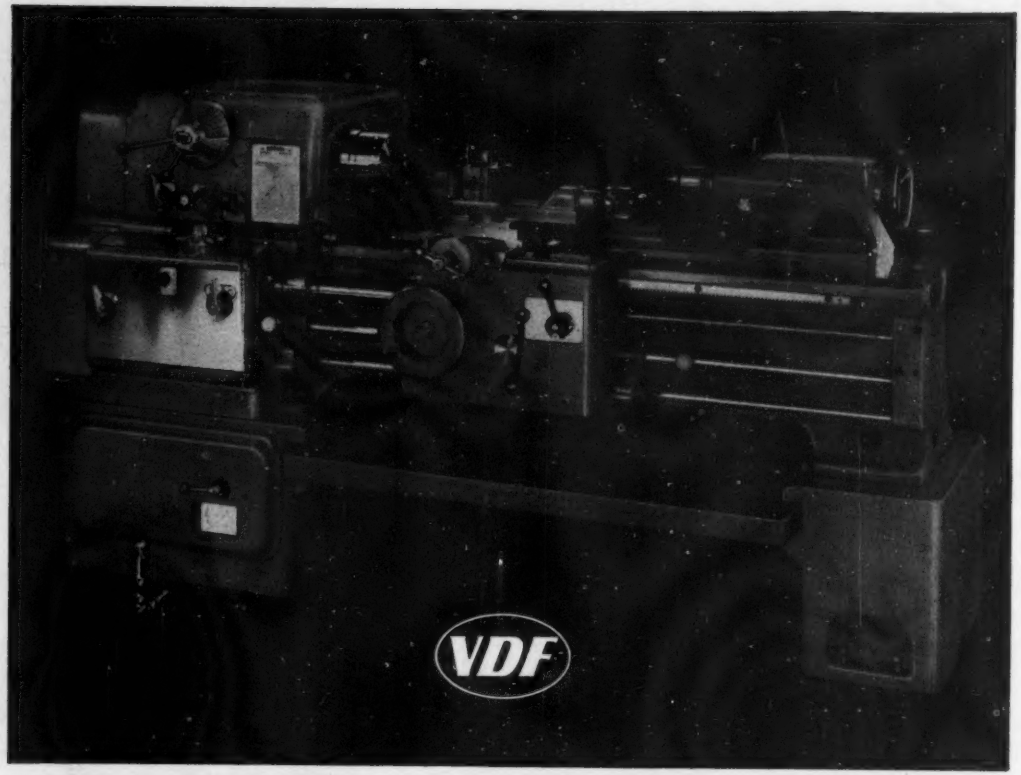
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swing over bed	15½"	18"
centre distances	29½"	30½"
height of centres	7½"	9"
main spindle bore	2"	2"
no. of speeds	18 or 30	18 or 30
speeds—r.p.m.	11-2240	11-2240

Sole British Agents

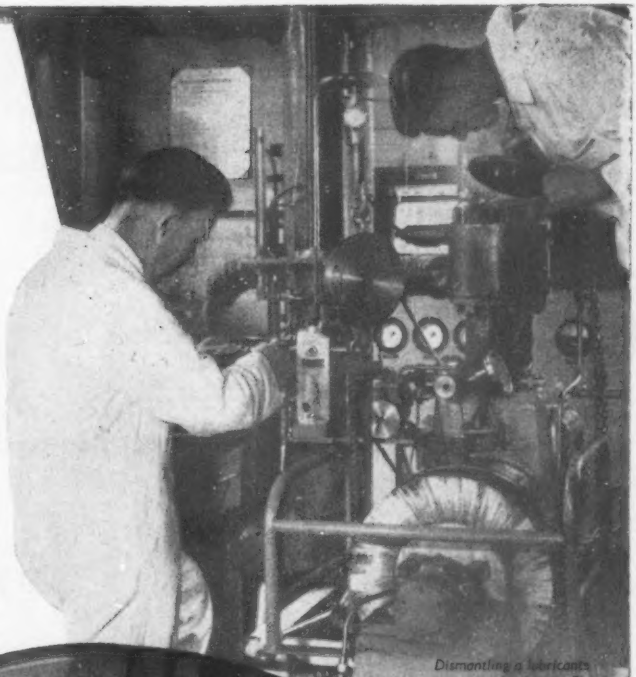
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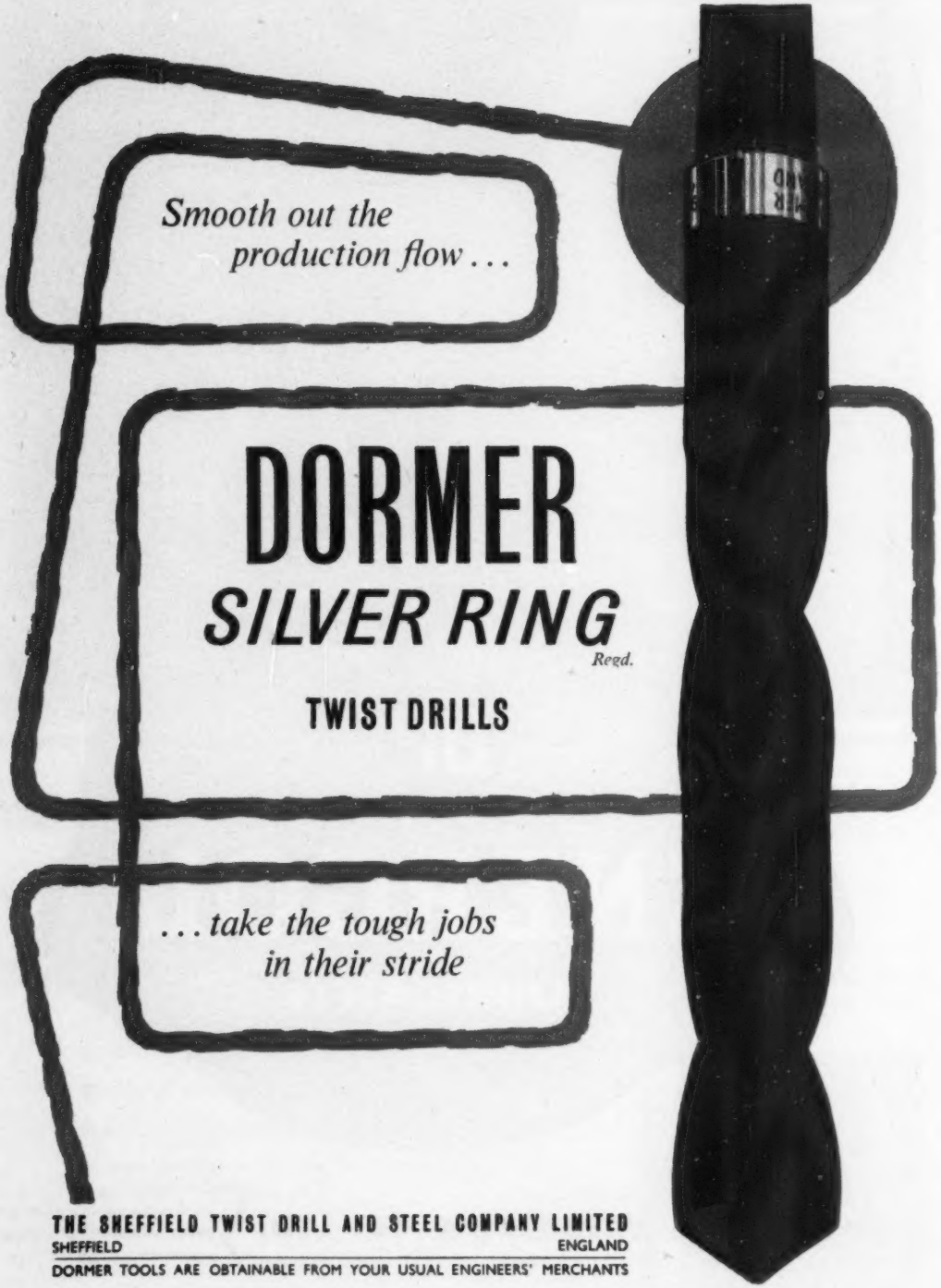
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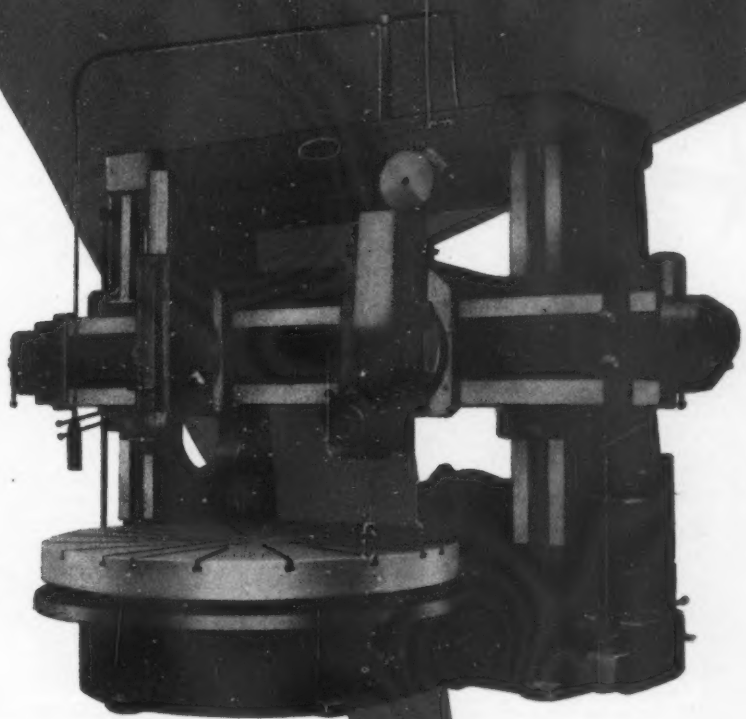
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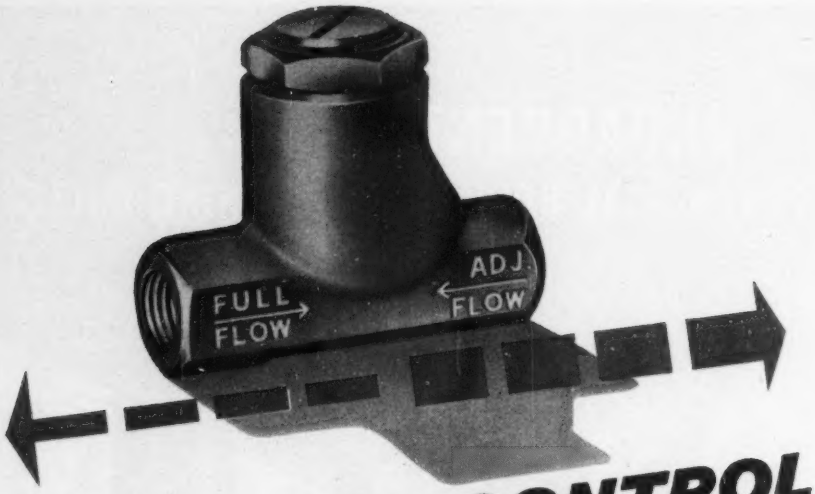
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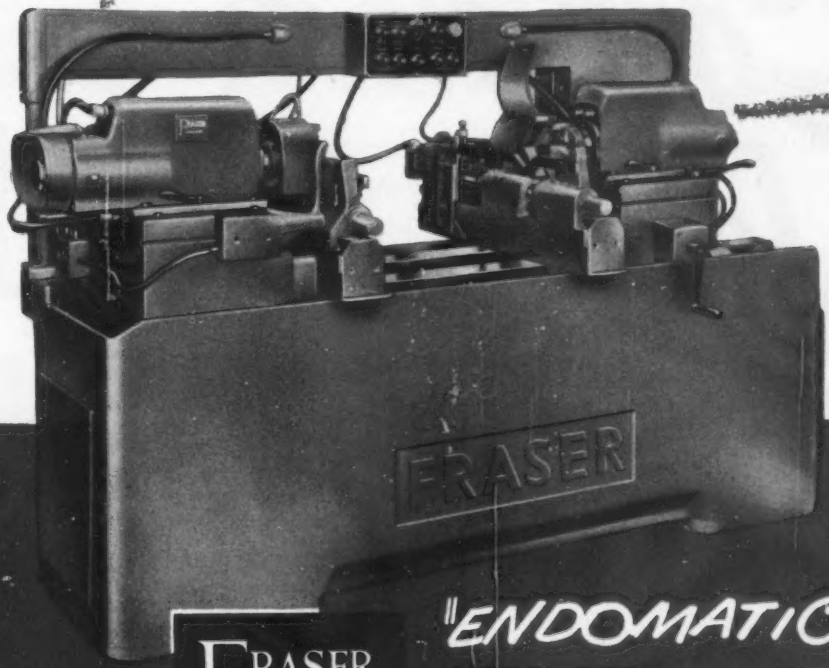
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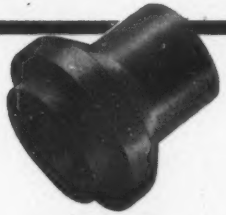
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KE 40 A.M. also gives highest cutting speed combined with long tool life.

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PRODUCTION	Completely auto	Completely auto
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'Perspex' acrylic sheet is available in a very wide range of thicknesses in transparent, translucent and opaque colours as well as clear sheet.

Carville Ltd., made the 'Perspex' components illustrated here, for the rigid submerged repeaters used on the Transatlantic Telephone Submarine Cable from 'Perspex' acrylic sheet. These repeaters have to withstand continuously 2,500 volts D.C.

'PERSPEX'

'Perspex' is the registered trade mark for the acrylic sheet made by I.C.I.

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P.457


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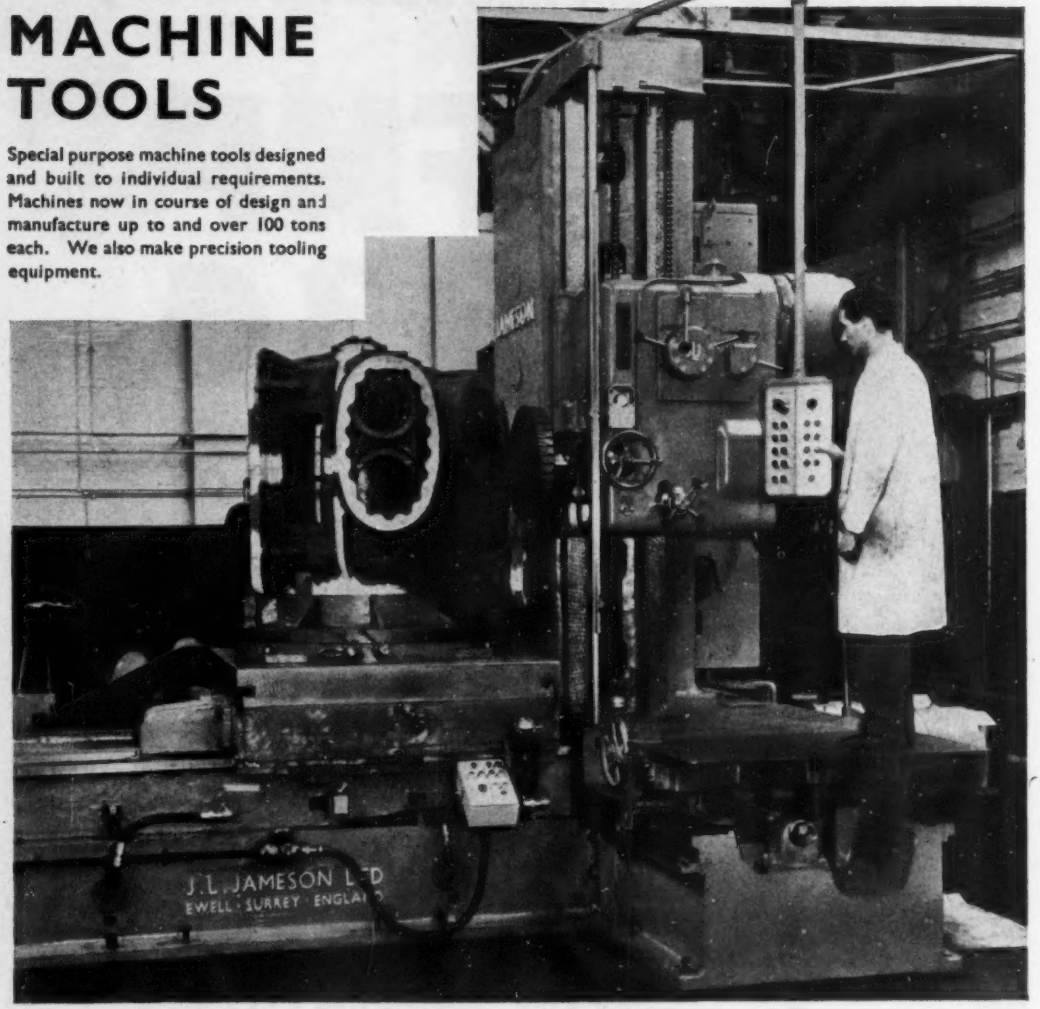
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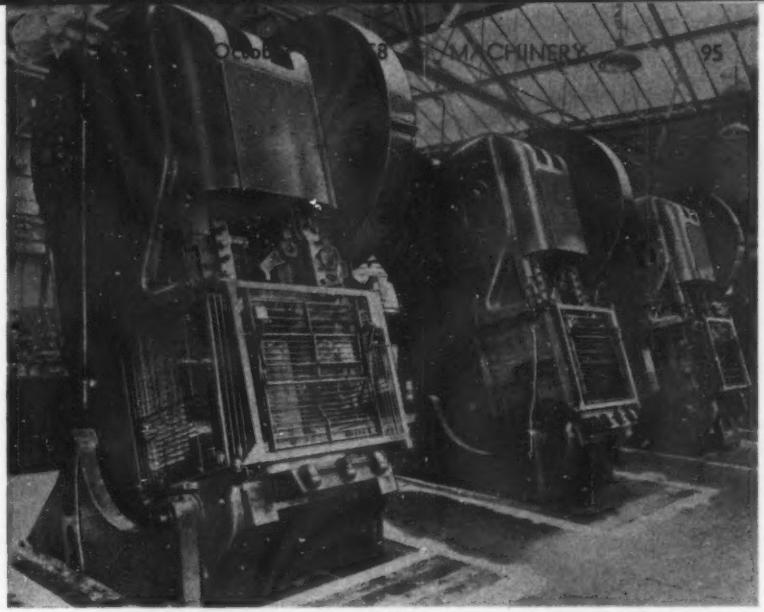
Face milling cylinder head faces on compressor crankcase, also bored on the same set-up.

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In this, the most competitive of businesses, Bliss presses are producing just about any stamped metal part needed in the manufacture of toys.

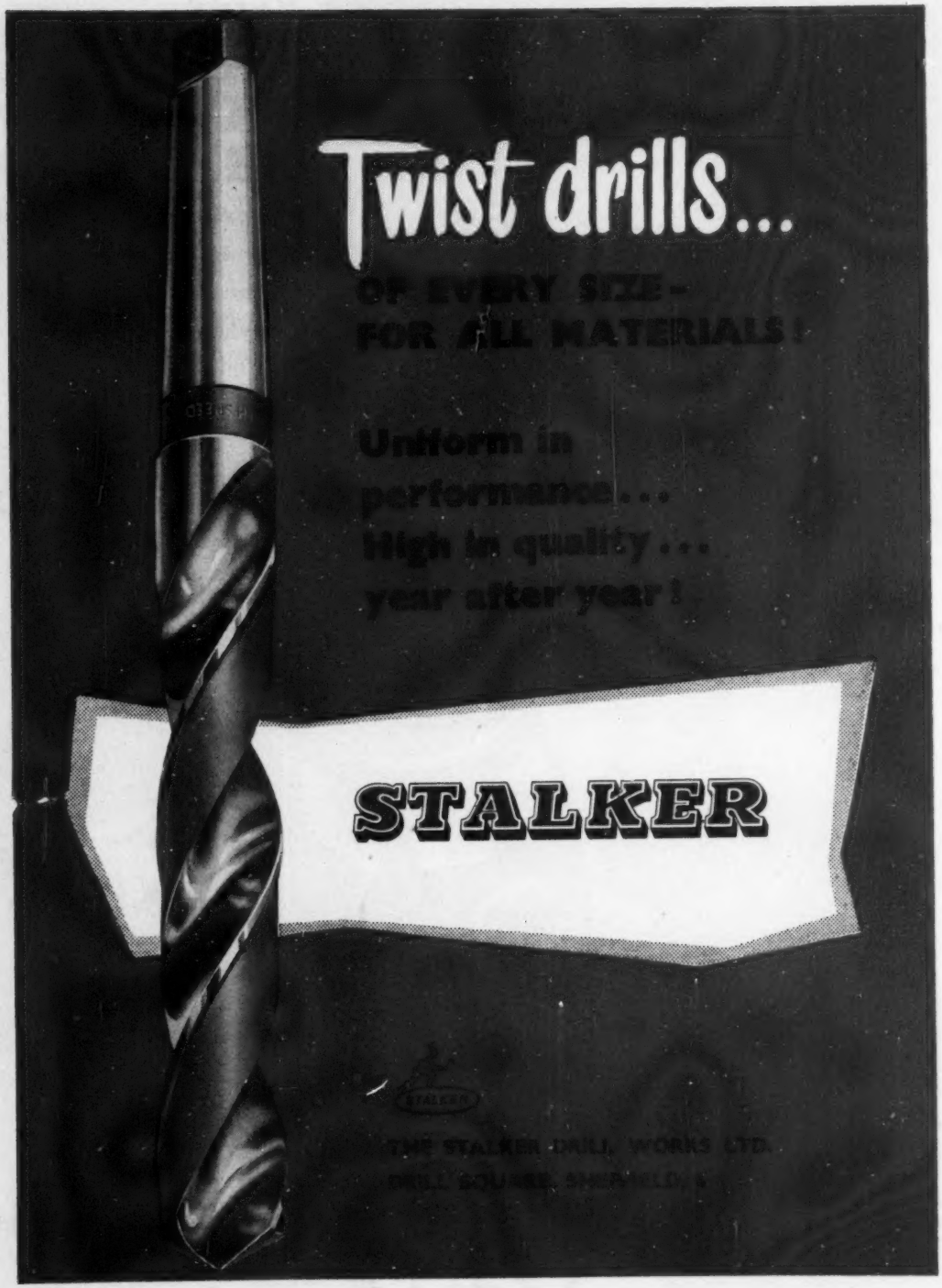
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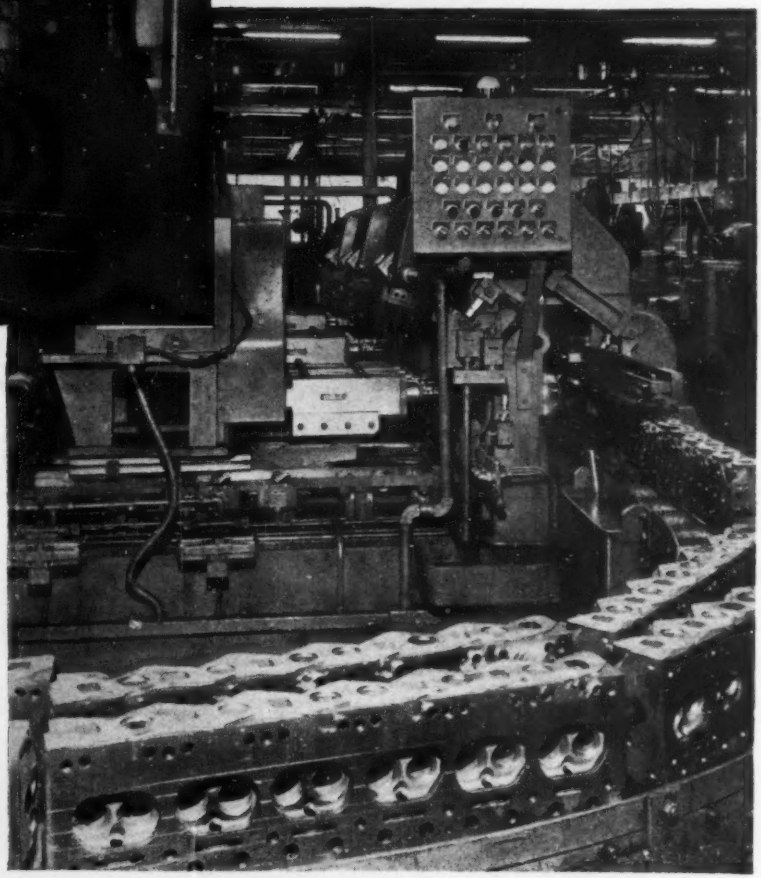
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The continuous processes involved in producing the cylinder heads and cylinder block main bearing caps for all Vauxhall Victor, Velox and Cresta engines call for control mechanisms which ensure complete uniformity and flexibility and contribute to cost-reduction. VICKERS-DETROIT Oil Hydraulic mechanisms offer you these same advantages





(Above) the C.V.A. Kearney and Trecker 20-Station Transfer Drilling and Milling Machine for drilling, reaming, capping and lock tag slot milling operations on cylinder block main bearing caps. This machine cycles at 85 components per hour. To the right is the Ex-Cell-O 9-Station Transfer Fine Borer machining to fine bore the holes to receive the valve guides and to form the valve seat: cycling at 76 components per hour. All fixtures and transfer systems are actuated by VICKERS-DETROIT *Hydraulic equipment.*

For further details please write for publication 1/40

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S.A.V. HYDRAULICS **197 Knightsbridge, London, S.W.7**



Someone once said;

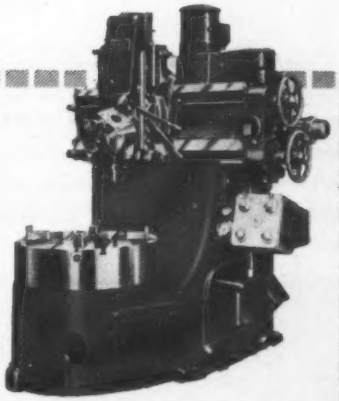
"Money is like time—
use it or lose it!"

That goes for us piece-workers too. Give us the chance to earn more by producing more, and we pay dividends.

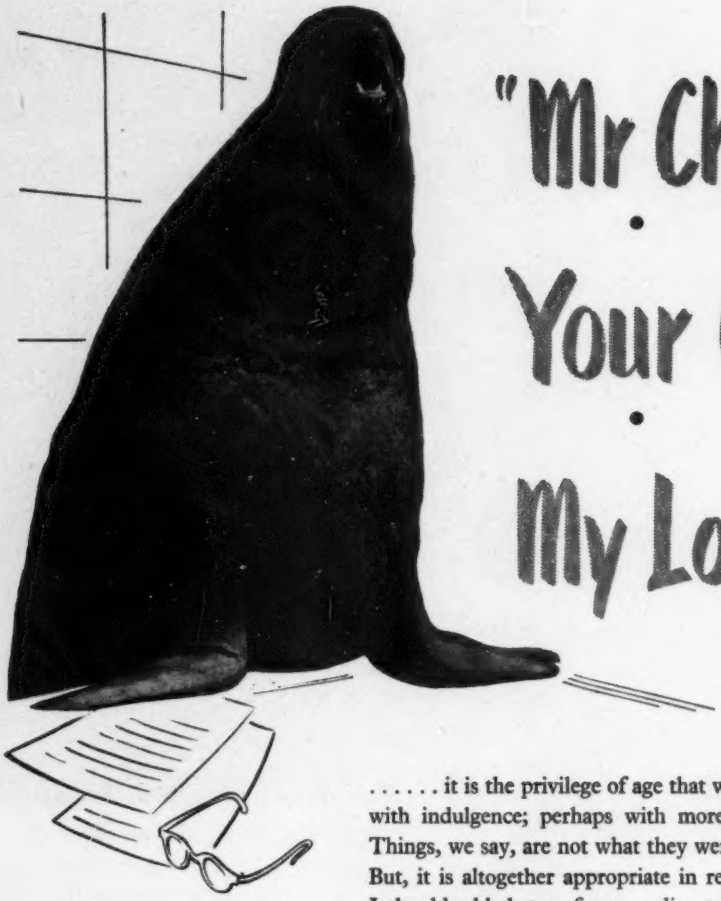
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When the machines in question are boring mills as popular as the Webster & Bennett, they are prepared to order well in advance. This is one of the reasons why we can seldom offer machines for early delivery.

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. . . . . it is the privilege of age that we can look back upon the past with indulgence; perhaps with more indulgence than it justifies. Things, we say, are not what they were. And it is true, *they are not*. But, it is altogether appropriate in responding to this Toast*, that I should add that so far as *sealing problems* are concerned this is a matter more for commendation than regret . . . . . ."

The Toast....** "Mechanical Seals"—**coupled with the name** "Crane Packing Limited," **as they are by engineers who have had experience of using them. A new, revised and enlarged CRANE Mechanical Seals Catalogue has been published, and if you wish to receive a copy of this catalogue-cum-reference book to mechanical seals, please send us your name, and the name and address of your Company.



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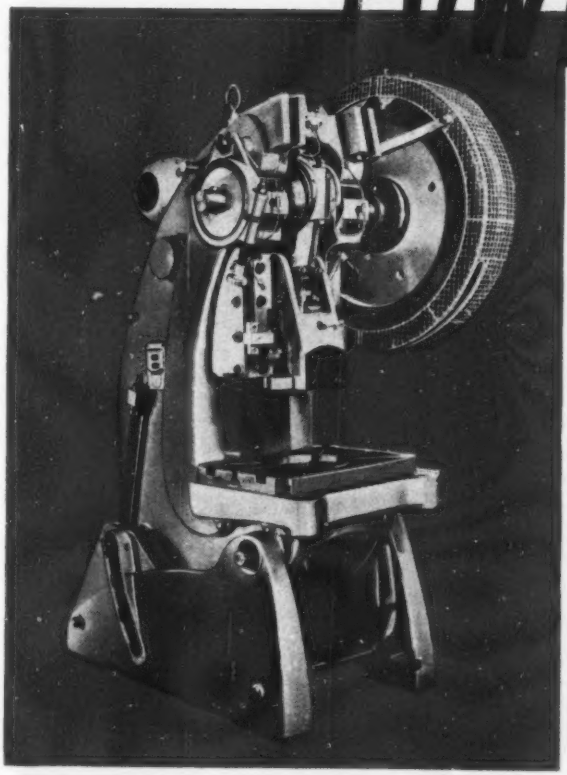
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New in design

Advanced in performance
Clutch virtually indestructible
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40-TON

MADE IN ENGLAND



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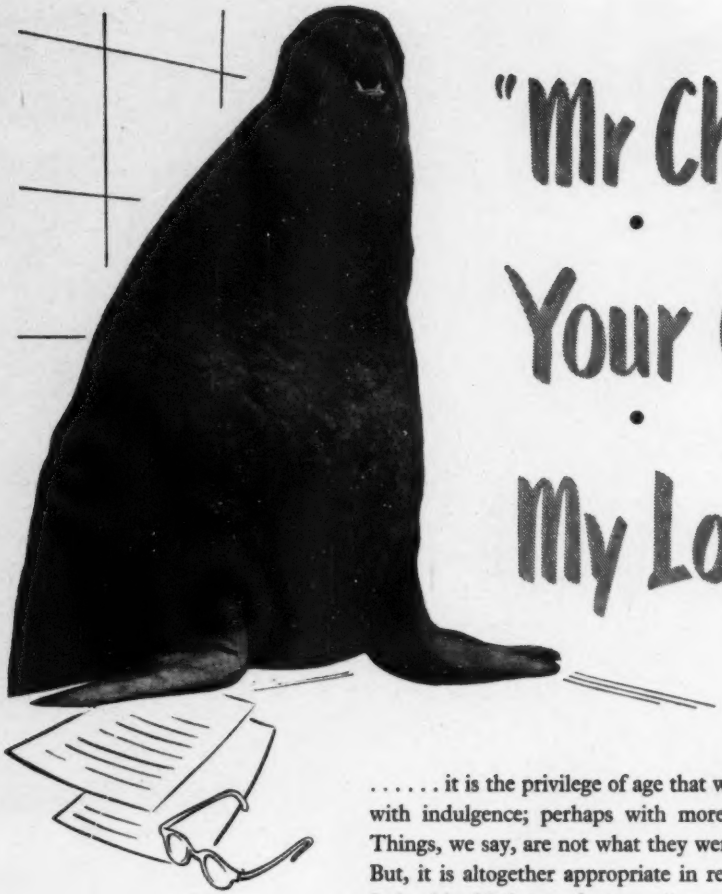
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Strokes/min. ..	100	50
Stroke Adjustment	⅜″ to 3⅜″ (8 positions)	1½″ to 4½″ (8 positions)

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. . . . . it is the privilege of age that we can look back upon the past with indulgence; perhaps with more indulgence than it justifies. Things, we say, are not what they were. And it is true, *they are not*. But, it is altogether appropriate in responding to this Toast*, that I should add that so far as *sealing problems* are concerned this is a matter more for commendation than regret . . . . . "

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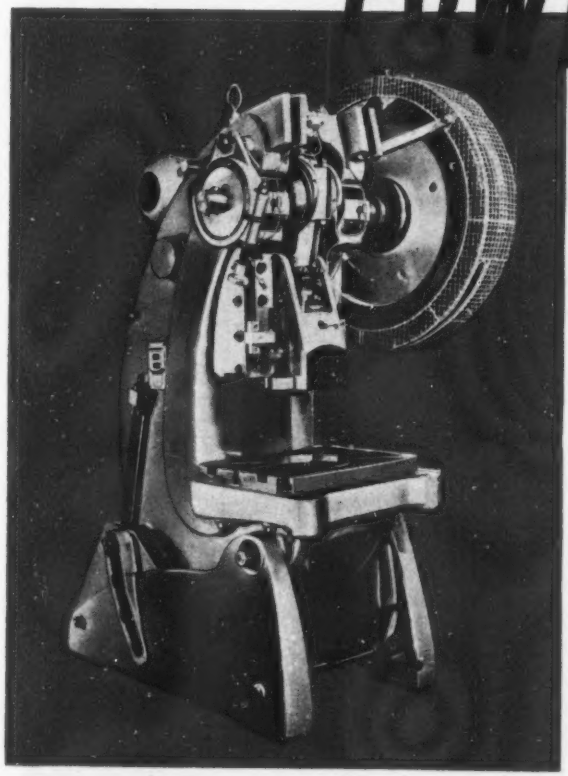
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New in design

Advanced in performance
Clutch virtually indestructible
POWER 40-TON PRESS

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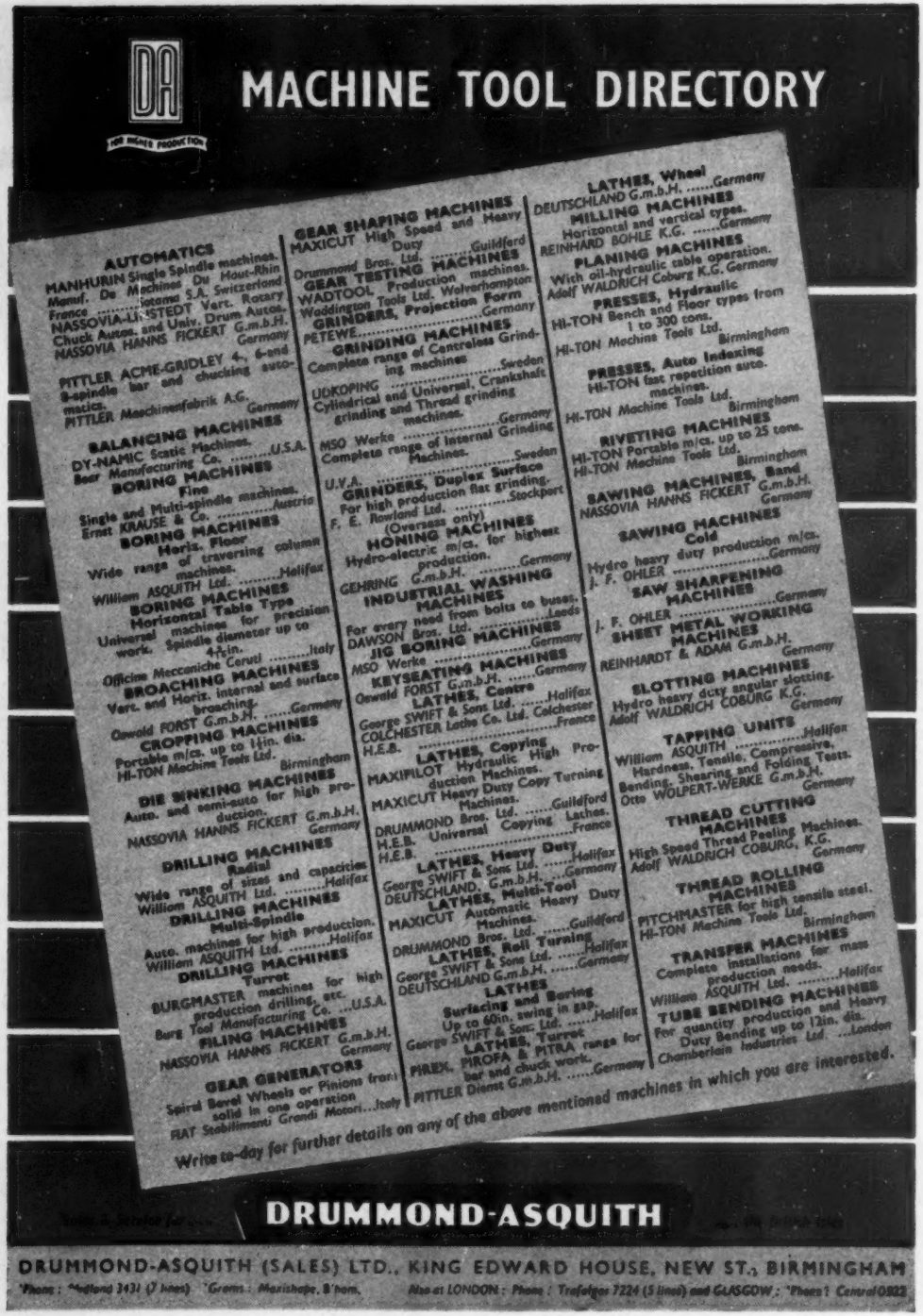
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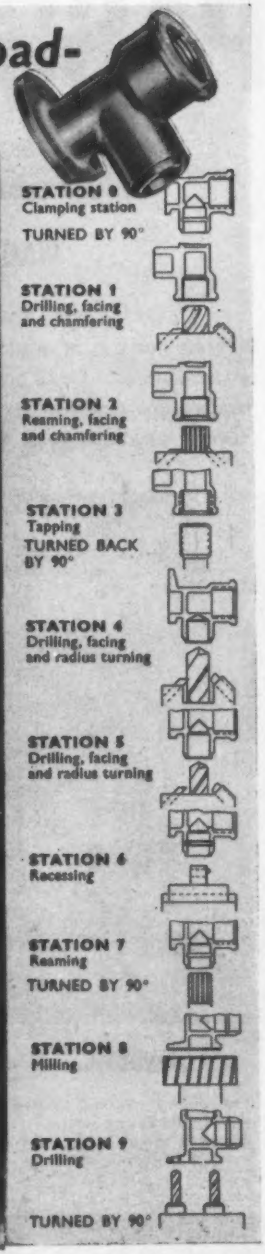


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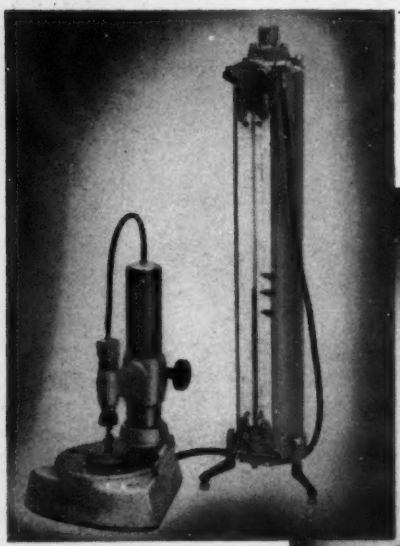
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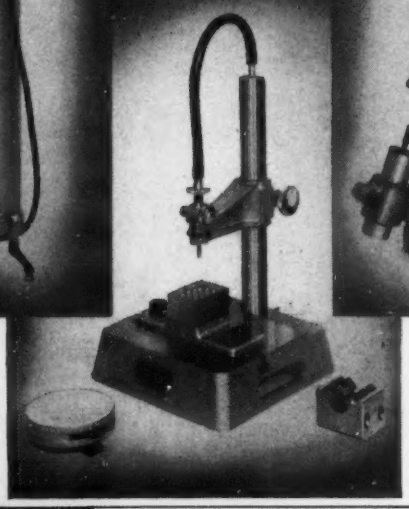
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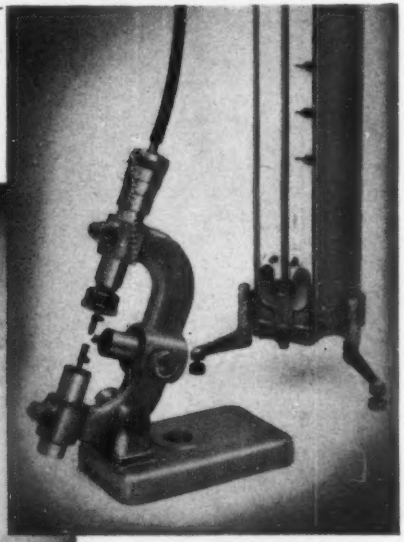
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LESLIE R. MASON
Managing Director

CHARLES H. BURDER
Editor

•

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CONTENTS

Editorial PAGE

The Need for Reducing Drawing Office Time 975

Principal Articles (*For Abstracts see next page*)

Machining Blades for Gas Turbine Units 976
Developments by Georg Fischer 987
The New Raleigh Moped 996
Centre National des Industries et des Techniques, Paris 1000
Churchill Fully-automatic Production Line for Layshaft Cluster Gears 1017

Short Articles

Klockner-Moeller Switchboards with Transparent Covers .. 986
An Air-operated Cylinder Tube Clamping Fixture 999
Extensions at Arthur Balfour & Co., Ltd. 1023

Die Casting Supplement

Safety Arrangements for Pressure Die Casting Machines 1003

News of the Industry

Keighley 1025
Classified Advertisements 151
Index to Advertisers 183

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Abstracts of Principal Articles

Machining Blades for Gas Turbine Units P. 976

This article, which is the third of a series describing the methods employed by the B.R.D. Co., Ltd., for the production of gas turbine blades under contract, deals briefly with milling, grinding and polishing operations performed on aerofoil surfaces with the Ex-Cell-O range of specialized machines. Details are then given of the procedure adopted for the production of the 3-dimensional cams employed on these machines. With the aid of enlarged drawings, cams of modified form are first produced on a vertical milling machine equipped with the E.M.I. system of punched-tape control. These cams represent sections through the blade aerofoil, and they are employed on another special machine for controlling the path of a milling cutter whereby the master cams for the Ex-Cell-O machines are produced. Finally, the application of a copy-milling unit to the machining of the root fillet radii between the platform faces and the aerofoil portions of certain blades is discussed. This method requires two separate set-ups for the concave and convex sides of the aerofoil portion, and the areas surrounding the leading and trailing edges are then finished by hand. (MACHINERY, 93—29/10/58.)

Developments by Georg Fischer... P. 987

Georg Fischer, A.G., Schaffhausen, Switzerland, builders of the +GF+ range of copying lathes, have recently introduced a modified machine for turning operations with ceramic tools. The structure has been specially strengthened, and a 30-h.p. motor is fitted, the spindle speed range being 224 to 2,800 r.p.m. An improved type of transfer mechanism has been developed for linking two or more type KDM 7/50 machines, and a thread chasing attachment has been introduced to extend the scope of all machines in the +GF+ range. Two fully automatic machining lines have been built for operations on main transmission shafts, and each line comprises three KDM—11/70 copying lathes equipped with type ULA-11 universal automatic loaders, and linked by power-driven and gravity feed conveyors, the latter serving as work-banks. The loading equipment is air operated, and is fully interlocked with the machines. (MACHINERY, 93—29/10/58.)

The New Raleigh Moped ..... P. 996

Raleigh Industries, Ltd., Nottingham, have developed a new moped, which is now being produced at an average rate of approximately 700 per week. The machine is of a particularly simple design, without a clutch or gearbox, and control is effected by means of the throttle and a decompressor valve, actuated by a single twist-grip control on the handle-bar. A special assembly department has been established at the Nottingham works, to which parts are supplied from the main factory, and flow-line production is employed. (MACHINERY, 93—29/10/58.)

Safety Arrangements for Pressure Die Casting Machines ..... P. 1003

Based partly on a recently-issued report of a sub-committee appointed by the Technical Committee of Z.A.D.C.A., this article is concerned with the dangers normally encountered in the operation of pressure die casting machines and with the methods adopted by certain of the leading companies to overcome them. Some simple hand- and power-operated guards, which shroud the die area and prevent the escape of molten metal—a major cause of accidents—are first considered, and a variety of guards employed on different machines are illustrated. Most power-operated guards are moved by means of long-stroke air cylinders, and the weight of large units may result in comparatively slow movement, particularly if the air pressure is reduced to a value low enough to prevent injury to an operator if trapped by a guard. Interlocking of the guard with the cycle, so that the machine cannot be operated until the guard is closed, is next considered, and there follows a discussion of guarding against trapping, by fitting an exhaust valve, mechanically linked to the guard, to the pressure side of the die-closing cylinder. More positive means of guarding against trapping by interposing a mechanical stop between the open platens is next considered, and a mechanism whereby the moving platen can be automatically stopped at any point in its travel is then described. Details are next given of a fully-automatic guarding system, capable of wide application, which gives protection against both burning and trapping, and finally, brief reference is made to a system based on control of the machine according to die temperature, which incorporates an efficient guarding arrangement. (MACHINERY, 93—29/10/58.)

Contributions to MACHINERY

If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

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The Need for Reducing Drawing Office Time

As more intensive methods of production, involving higher degrees of automation, are introduced, manufacturing processes are carried out more rapidly and economically, and overall savings are obtained in spite of the high cost of the special equipment and tooling that are normally required. With further advances in mechanization, however, the time needed to prepare for the manufacture of a new or substantially modified product, and the initial expenditure involved, must both assume increasing importance. Considerable attention is therefore being directed to the design or arrangement of automatic transfer machines or machine lines, for example, with the object of ensuring greater adaptability to accommodate product changes. In spite of what may be accomplished in this connection, however, it is likely that the requirements for special machines and tools, also for work handling, gauging and assembly equipment will continue to rise. At the same time, in order to meet the demand for progressive elimination of manual operations, many individual items of equipment must become increasingly intricate.

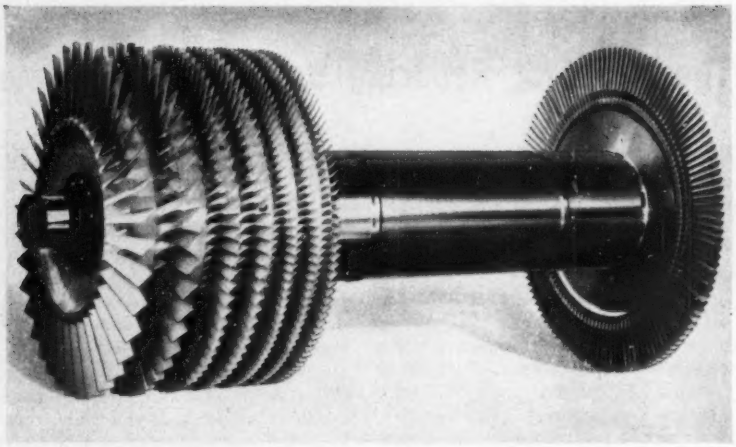
It follows that a growing volume of "special" work must be undertaken by machine tool builders, by other companies concerned with the supply of production equipment, including tools and gauges, and by the tool-making departments of manufacturing firms. The design and preparation of working drawings for machines and equipment of this nature may necessarily occupy considerable time, and despite the important advances that have hitherto been made in connection with machine tools intended primarily for tool-room work, the period of construction may also be protracted. Where the end product is of an elaborate nature, therefore, the interval between the finalization of its design and the start of highly automated manufacture may tend to become excessive. Recently, however, there have been some very significant developments in control systems for machine tools whereby certain tool-room operations can be greatly accelerated, and, in the future, productivity in this field is likely to be substantially increased. Some examples indicating the substantial savings in time that may be obtained by employing tape-controlled machines for such work as template milling and die sinking were recently quoted in MACHINERY, and in another instance, it is reported, a large hammer die was machined in only one-third of the time that would formerly have been required, and with improved finish and accuracy.

This ability to translate the work of the designer and draughtsman much more rapidly into finished tools and machine components must necessarily tend to disturb the existing balance between the outputs of the drawing office and production departments of many establishments, since larger numbers of working drawings will be needed to keep the more productive machines occupied. The position will be aggravated, moreover, by the fact that additional stages will be necessary to provide tapes for machine control instead of drawings for the guidance of operators.

By reason of the nature of his work, and the fact that he will be called upon to solve increasingly complex problems, it can hardly be expected that the average designer will be able to increase his output significantly, although some assistance may be afforded, for instance, by the provision of adequate calculating facilities. In general, however, design work in greater volume and intricacy can only be provided by more and better-trained designers. For some years there has been a shortage of competent men in this field, and if the scarcity is not to be accentuated in the future, still greater efforts must be made to increase recruitment and ensure effective instruction. Apart from the greater output that would naturally be expected from a larger design staff, further benefits might sometimes result from the additional possibilities of specialization and team-working that would be afforded.

There remains the task of translating the work of the designer into the form required by the automatic machine programmer or the machine operator, and it does appear that in many drawing offices there are possibilities of increasing output by greater productivity as well as by expansion. An important contribution to this end could often be made by the wider adoption, in the design department, of standards for mechanism components, and there are various short-cuts and expedients whereby the task of preparing working drawings may be lightened. For the most part, however, drawing office productivity will depend

(*Continued on page* 1027)



Machining Blades for Gas Turbine Units

Methods Employed by the B.R.D. Co., Ltd., Aldridge, Staffs.

The first article of this series, which appeared in MACHINERY, 92/1082—9/5/58, gave a brief history of the B.R.D. Co., Ltd.—a member of the Guest, Keen & Nettlefolds Group—who now occupy a large modern factory on the Redhouse Industrial Estate at Aldridge, Staffordshire. Mention was made, in that article, of the considerable diversification of the activities of the company following a reduction in the demand for gas turbine blades, and the methods employed for finishing precision-forged aluminium-alloy blades for gas turbine compressor rotor blades were considered. A second article, in MACHINERY, 93/400—20/8/58, was concerned with machining operations on rough-forged blades of stainless steel for compressor stators and rotors, including the generation of the aerofoil surfaces on Jameson machines of the abrasive band type.

In this, third, article are described some of the advanced methods and equipment employed for machining master cams for the well-known range of Ex-Cell-O blade aerofoil milling, grinding and polishing machines. These machines are still extensively employed for the production of stainless steel compressor rotor and stator blades, and for Nimonic alloy turbine blades. Among the blades produced by the company are those for the compressor and turbine rotors for the Bristol Orpheus engine, shown assembled in the heading illustration. Blades are made for most of the principal engine manufacturers in this country, and, in all, some 250 different designs are produced.

OPERATIONS ON EX-CELL-O MACHINES

A close-up view of a typical set-up on an Ex-Cell-O No. 86 blade aerofoil milling machine is given in Fig. 1, and batteries of machines of this type, which was first described in MACHINERY, 79/776—1/11/51, are installed in the factory. The range includes blade grinding and polishing machines of somewhat similar design, and in the shop there are lines each comprising three milling, four grinding and two polishing machines, all tended by one operator. On such a line, successive milling, grinding and polishing operations on a particular blade are normally carried out, the cycle time for polishing being shorter than for milling or grinding. The series of operations on the root end, and on the locating pip at the end of the aerofoil portion of a compressor stator blade of the type shown in the foreground in Fig. 1, was described in the second of the articles mentioned above.

Choice of the method to be employed for finishing the aerofoil portion of this type of blade is governed by such factors as the depth of the form or amount of twist of the blade section, the rate of twist, the availability of suitable tooling, and the current shop loading. Although most forms could be produced by either method, blades with flatter

forms and small amounts of twist are normally finished on Jameson machines, and the more curved and twisted shapes, up to a certain size, on the Ex-Cell-O equipment. It will be apparent from Fig. 1 that the blade is clamped at the root end between two pairs of jaws, and the latter are closed by a draw-bar which extends through the machine spindle from the left. One jaw of each pair is fixed, and the other pivots to apply the clamping pressure so that the root end of the blade is accurately positioned in two directions.

A centre-hole in the locating pip at the end of the aerofoil portion is engaged by a tailstock centre, and, on the Ex-Cell-O 86 machine, the thin blade is also supported by a series of spring-loaded rollers, which are clamped hydraulically when the machine cycle-start button is depressed. The entire upper portion of the machine, on which the spindle and tailstock are carried, is hinged at a point at the rear and a strong tension spring pulls the front end downwards. In this way, a large 3-dimensional cam on the spindle is held in contact with a roller in a bracket secured to the machine base. In addition, the head is mounted on slides, so that it can be hydraulically traversed in a longitudinal direction, and during this movement the cam causes the head to rise and fall, to vary the relationship between the blade surfaces and a cutter *A*, Fig. 1.

At the end of each cutting stroke, the clamping pressure on the spring-loaded supports is released, and a small motor on the head indexes the spindle and its cam, through an angle determined by the positions of pins in a circular plate at the left-hand end of the spindle. A general view of the machine showing this index plate, at *B*, is given in Fig. 2, and in this illustration the tension spring, mentioned earlier, may also be seen. The cutter spindle on this machine is driven by a motor of 1 h.p., and the cutter must be of sufficiently small diameter to enter the smallest radius of the concave side of the blade to be machined. For the medium-sized blade shown, a cutter of 1·73/1·77 in. diameter, with 30 teeth ground to a 0·125-in. radius, is employed, and is run at a speed of about 300 r.p.m. The cutter is of high-speed steel, as cutters of this material have proved more economical than those with carbide tips for this operation.

A slow feed rate of about 10 sec. per pass of approximately 4 in. is employed for the initial cuts on a rough-forged blade of stainless steel, and the rate is subsequently increased automatically to about 4 sec. per pass when less of the cutter periphery is in engagement with the blade. Milling is not normally performed on the leading and trailing edges of the blade since there is very little material to be removed from these surfaces, and pins are therefore omitted from the indexing wheel *B*, Fig. 2, with the result that the spindle is turned through a greater angle as the edges approach the cutter. For the milling operations on a blade such as that shown, the cycle time is about 2½ min., and an average of 10 to 12 blades is completed per cutter regrind.

Stages in the machining of the aerofoil on a stainless steel compressor stator blade, of the type shown in Fig. 1, are illustrated in Fig. 3, where the rough blade, with only the root and locating

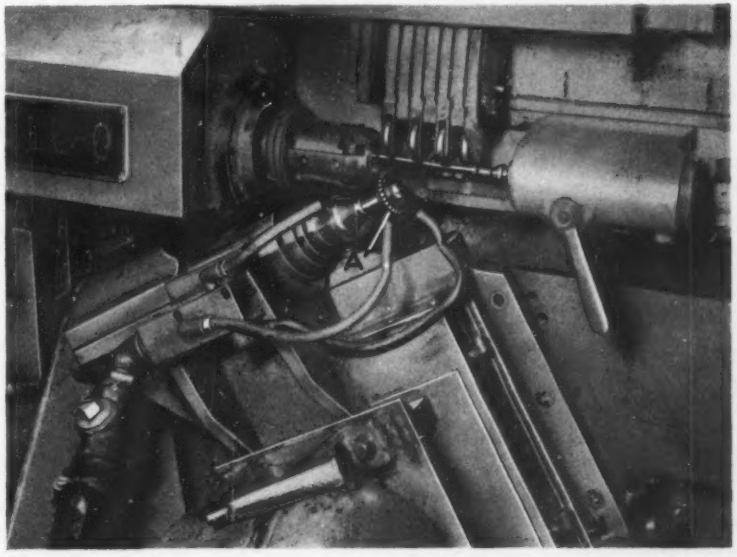


Fig. 1. A close-up view of one of the Ex-Cell-O type 86 blade aerofoil milling machines installed at the works of the B.R.D. Co., Ltd., showing the method of holding the blade and supporting it against the pressure of the cutter *A*

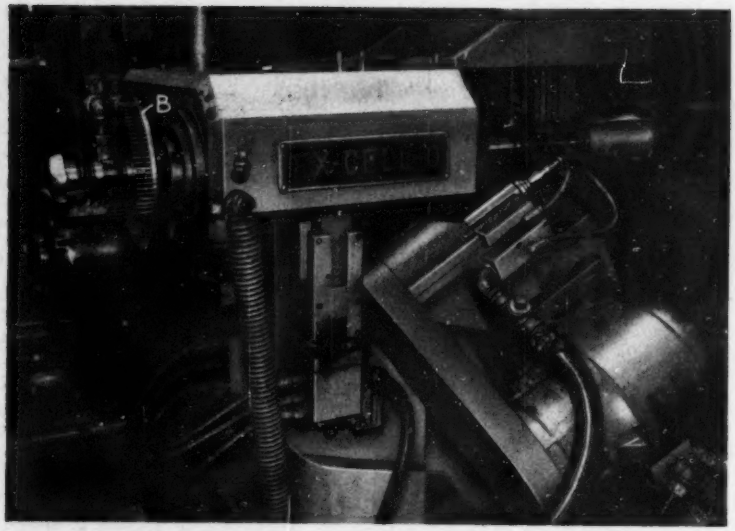


Fig. 2. Indexing of the blade and its control cam, on a common spindle, is effected by a small motor at the rear. Current supply to the motor is cut off by one of the pins on the wheel *B* when the spindles have been turned through the required angle

pip machined, is seen at the left, followed by examples, which have been milled, ground, and polished on Ex-Cell-O machines. For the grinding operation, which follows milling, the machine is arranged so that the spindle rotates continuously, and the head is traversed by a small increment at each revolution. A grinding wheel of suitable diameter, and dressed to the required radius, replaces the cutter, and is driven at 6,000 r.p.m. For grinding the blade shown, the cycle time is of the order of 7½ min.

On the polishing machine, which normally has the shortest cycle, the arrangement is similar to that employed for grinding, except that the wheel and spindle are replaced by a band-polishing head. This head carries a crowned rubber wheel, over which runs an abrasive band of about ½-in. width, at a surface speed of approximately 5,000 ft. per min. For the type of blade under consideration, a 2 min. cycle normally suffices. For the polishing operation, the head is traversed by a screw-feed unit, the nut of which is driven continuously by a separate motor, to ensure smooth surfaces. The cam employed on the polishing machine is of slightly different design from those for the other two units, and has slight rises corresponding to the leading and trailing edges.

This technique is necessary because extra metal would be removed by the band on thin edges, and blades are hand finished to remove

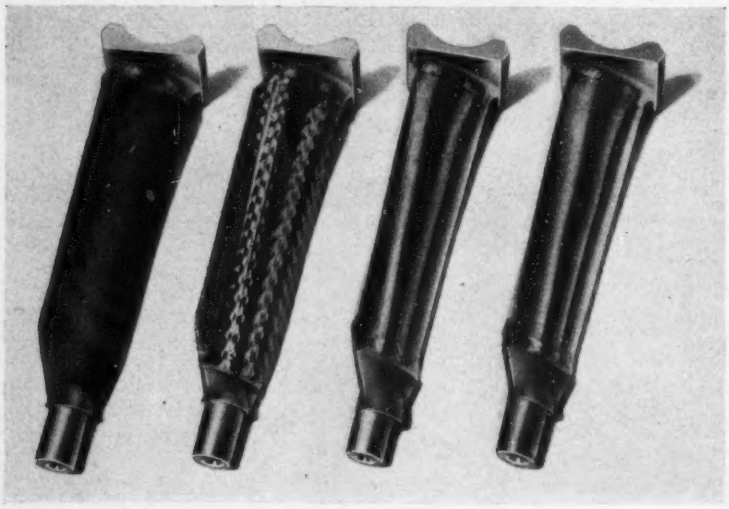


Fig. 3. Some stages in the machining of the aerofoil portion of a stainless steel compressor stator blade. The blank with the root and locating pip machined is seen on the left, and to the right are blades with milled, ground and polished aerofoil portions

any small imperfections before they are inspected. The aerofoil form is checked on O.M.T. projectors, of which large numbers have been installed, and other special equipment, including Sigma comparators of the type described in MACHINERY, 91/604—13/9/57. In addition, the root fillet radius is blended into the aerofoil at this stage, and the locating pip at the end of the aerofoil portion is then cut off, leaving the required length of blade, on one of a battery of adapted surface grinding machines, as described in the first article.

MAKING MASTER CAMS FOR EX-CELL-O MACHINES

One of the early difficulties encountered in the application of the Ex-Cell-O machines described above was associated with the production of the 3-dimensional cams employed to control the blade forms. As described in MACHINERY, 86/308-11/2/55, the most straightforward method of producing these cams, employed by A. A. Jones & Shipman, Ltd., requires considerable time. The first step is to draw sections through the aerofoil, enlarged 20 times, on glass sheets, from data which is supplied by the customer. These drawings are then transferred by means of a photographic process to steel sheets about ¼ in. thick and the outlines are cut out with a bandsaw and filed accurately to the lines. A special machine is next employed to produce cam plates of the type shown in the foreground in Fig. 4, the templates being reduced 20 times.

On each cam plate shown, the outline of the blade section is modified so that the sharp leading and trailing edges are rounded. For this purpose, circles of uniform size are drawn with their centres on lines which pass through the centre of rotation of the cam. Each circle passes through the point of intersection of the radial line and the aerofoil profile.

After the set of steel cam plates for a complete blade has been hardened, they are mounted on a hollow mandrel, with pieces of aluminium plate interposed, in such a way that each cam plate is held at the correct position in relation to the first plate corresponding to the root end of the blade. Surplus aluminium is then machined or filed away until the plates are flush at all points, to produce the cam seen at the top in Fig. 4. This cam can then be employed as a master for making a hardened steel production cam for use on an Ex-Cell-O machine, with the aid of a modified machine from the range. This complicated procedure has now been considerably simplified by the installation of automatic tape-controlled and form-milling machines, whereby the master cam is produced in a much shorter time.



Fig. 4. A finished master, made by the assembly of cam blanks of the type seen in the foreground, from which a 3-dimensional cam for an Ex-Cell-O aerofoil milling, grinding or polishing machine was formerly produced

TAPE-CONTROLLED MILLING OF CAM PLATES

The process to be described involves a somewhat similar series of steps to that outlined above, and at the first stage a number of blade sections is drawn on a sheet of white Astrafoil (D.E.P., Ltd., Frith Park, Walton-on-the-Hill, Tadworth, Surrey), plastics material, at an enlargement of 50 times, to ensure ultimate accuracy. This work is performed on a conventional draughting machine and for most blade lengths, five or six sections are sufficient. Each drawing is then photographed, and a reduced print is made on a glass plate at 10 times the original size, a black outline being obtained on a transparent screen, of the correct size to fit into an O.M.T. projector.

A sheet of Astrafoil material is then secured to the screen with tape, and the aerofoil form is slightly modified to provide a slightly enlarged radius at the leading edge, and to move the trailing edge further out, to compensate for the tendency of the Ex-Cell-O machines—especially that employed for polishing—to remove more material at these positions. In addition, the centre of rotation of the blade is marked and the angle of twist of the particular section in relation to the root end

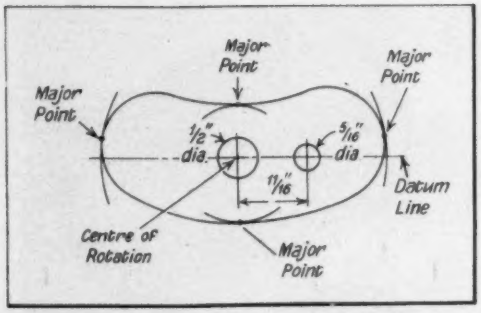


Fig. 5. In the preparation of a cam representing a section of a blade aerofoil, an envelope outline is drawn at a distance of 7½ in. from the edges of an aerofoil profile enlarged in the ratio of 10 : 1, and major points are marked as shown

is determined. A pair of dividers is next employed, set to give a diameter 10 times that of the modifying circle previously mentioned, which is usually ½ in., to draw a series of arcs in the manner already described, with their centres on radial lines.

The path to be followed by the cutter on the tape-controlled milling machine is next determined. Having decided the diameter of the milling cutter to be used, a further modified form is drawn. For this purpose, the dividers are set to give a diameter equal to that of the modifying circle plus the radius (enlarged 10:1) of the cutter. The normal cutter diameter is ½ in., and the dividers are set to give a diameter of 7½ in. A curve is then drawn tangentially to the resulting arcs, as seen in Fig. 5, and this curve represents the path of the cutter for producing a cam of the modified form shown in Fig. 4. From this curve is derived the information for punching the tape whereby the cam-milling machine is directly controlled.

DETERMINING THE CUTTER PATH

For machining the aerofoil section cams, a C.V.A.-Kearney & Trecker [E. H. Jones (Machine Tools), Ltd.] No. 2 CES, vertical milling machine is employed, a general view of which is given in Fig. 6. This machine is equipped with the E.M.I. system of numerical tape control for the longitudinal and transverse motions of the table, on which a 16-in. diameter rotary table is mounted. As described in MACHINERY, 91/1347—6/12/57, the machine has a maximum traverse movement of 10 in. under tape control in either direction, and the circular table can be turned, under tape control, in one direction only, through a total of 400 deg. From various articles which have been published, notably in MACHINERY, 87/144—15/7/55, it may be recalled that the electronic circuits for the E.M.I. numerical control system are so designed that the work is carried past the cutter in a series of smooth curves rather than in short straight-line movements. The system will interpolate the successive positions which the work is required to occupy from information relating to a number of fairly widely-spaced points defined in advance, and the successive smooth curves are of parabolic form, and

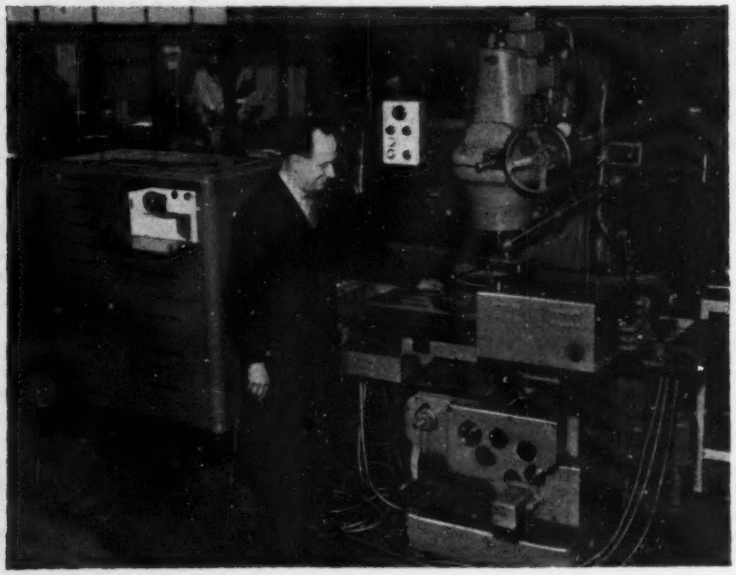


Fig. 6. A view of the C.V.A. - Kearney & Trecker vertical milling machine equipped with the E.M.I. system of punched tape control. For cam milling, rotary movement of a 16-in. rotary table is employed in conjunction with longitudinal movements of the main table

each passes through three adjacent defined points. For gradual curves, the defined points can be as much as 1 in. apart, but on curves of smaller radius, for example at the leading and trailing edges of the modified aerofoil section, the points are closer. Before selecting the points to define the cutter path, a convenient datum line is drawn through the centre of rotation of the cam, and the position of a locating dowel hole is marked on this line, as shown in Fig. 5. The dowel hole is subsequently employed to locate the cam correctly when milling the master cam, as will be explained.

Four major points are next marked on the curve representing the desired cutter path by scribing, with dividers, from the centre of rotation to the points at which the cutter will be nearest to and furthest from this centre. In other words, these major points represent the positions at which changes of direction of the cutter travel will take place. Each portion of the curve between two major points is next divided into an even number of parts, the spacing being determined by the amount of information required by the control system of the machine to enable the curve to be accurately reproduced. These divisions are normally of similar size, but where they are varied the increase or decrease in the spacing must be gradual. When a series of points has been obtained in this way, their positions relative to the datum line and the centre of rotation are measured and data defining them is entered in a table.

Two measurements are required to define each point, namely the distance from the centre of rotation and the angle which a line passing through the point makes with the datum line. As mentioned earlier, the total rotation of the table under numerical control is 400 deg. and this allows for the table to be turned through 20 deg. on each side of the datum line for the run-in and run-out of the cutter. Consequently, each angular measurement must be increased by the initial 20 deg. to provide for the approach of the cutter. These angular measurements are converted to decimals and are then divided by 40 to suit the measuring system of the machine. It may be noted that the measurements obtained at the enlarged scale are accurate to within about 0·005 in., which represents 0·0005 in. on the final form produced.

The points so far determined are related solely to the shape of the modified aerofoil section cam, and make no provision for the initial approach of the cutter or for its withdrawal after the table has turned through 380 deg. A suitable approach and run-out path for the cutter is therefore laid out relative to one of the major points, as shown in Fig. 7. The point *A*, which the cutter is to occupy at the start of the milling operation, must

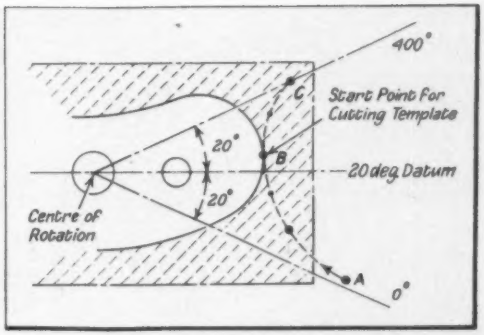


Fig. 7. In determining the path of the centre of the cutter relative to the work for milling a modified aerofoil-section cam, provision must be made for the approach and run-out of the cutter within 20 deg. on each side of the first major point

first be arbitrarily established, clear of the work and not more than 20 deg. from the datum line. A cutter approach curve is then drawn so that it is tangential to the major point *B*, and is divided into an even number of portions. Similarly, the path which the cutter follows after leaving the cam profile, to reach the completion point *C*, is drawn and divided, and for all the points thus obtained measurements are taken and added to the table, those for the approach being placed in front of the figures for the cam outline.

PUNCHING THE TAPE

An adapted Creed teletypewriter unit, as seen in Fig. 8, is installed in the drawing office and is employed for the preparation of the punched paper tape whereby the measurement data are fed into the electronic control unit of the machine, seen at the left in Fig. 6. The tape employed has a nominal width of ⅝ in. and provides for a maximum of five punched holes per row, in addition to the existing line of smaller holes employed near the centre, which serves for monitoring purposes. After passing the end of the tape through the punching unit, sufficient is drawn through to enable the machine unit to be easily threaded and hole punching can then begin. It may be noted that the typewriting mechanism of the machine has been retained so that a typed record of the punching is produced simultaneously, and this record can be employed for checking purposes if required.

Each of the light-coloured keys in the bank at the right-hand side of the machine, one of which the operator is seen in the act of depressing,



Fig. 8. Transferring the information obtained from measuring the cam profile drawing to the paper tape on an adapted Creed teletypewriter, which also produces a written record of the figures for checking purposes

represents a number from one to nine, and nought is obtained by means of a wide key near the lower edge of the bank, whereby the tape is indexed without being punched. When a key is depressed, one or more holes are punched in a line across the tape, the hole pattern corresponding to the particular number, and the tape is then indexed one space, ready to receive the next number. Each digit of a 5-figure number is punched successively, so that each group of five rows on the tap represents a complete number comprising between one and five digits. Numbers corresponding to the distance from the centre of rotation parallel with the longitudinal direction of movement of the main table and numbers representing the angle of rotation of the rotary table are punched alternately in the tape, and the machine reader is so arranged that signals are transmitted to the appropriate machine elements.

Most of the remaining keys on the Creed machine are lettered alphabetically and each represents a hole code which, when punched into the tape, will provide some specific instruction for the machine, such as the cancellation of previous instructions. The code punched as a result of the depression of this cancellation key ensures that the electronic units of the machine are cleared of all settings relating to the previous workpiece, and provision is next made for the positioning of the tables to bring the point *A* in Fig. 7 beneath the cutter centre. A button giving a hole pattern which results in the movement of the tables being halted is next pressed, after which the position of the point *A*, Fig. 7, is again punched, as a safety check. The remainder of the dimensions are then punched into the tape, finishing with the run-out instructions which bring the point *C* in Fig. 7 beneath the cutter centre, and, finally, the stop code is inserted.

A completed tape can be checked against the tabulated numbers, or it can be run through the machine control unit, with a writing pen fitted



Fig. 9. Close-up view of the rotary table on the tape-controlled milling machine showing a finished cam which is machined in a total time of about 7 min. An aluminium plate beneath the blank allows the full depth to be machined

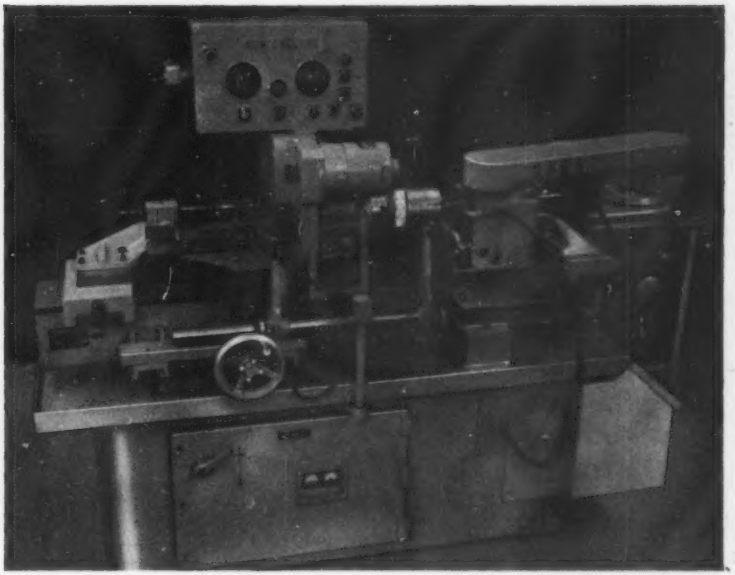


Fig. 10. Machining of the 3-dimensional cam for the Ex-Cell-O machine is performed on this Pratt & Whitney electronically-controlled profile milling machine with the aid of the cams produced on the machine in Fig. 6

to the spindle and a piece of paper on the rotary table, to check for any serious errors that are present. For milling a cam, the machine is set up as shown in the close-up view, Fig. 9. The fixture employed has a hardened post of ½ in. diameter, which is positioned at the centre of the table, and a locating dowel of $\frac{5}{16}$ in. diameter at a centre distance of $1\frac{1}{16}$ in., to suit corresponding holes machined in the cam blanks. In the fixture, each blank rests on a thin aluminium plate, to which it is clamped by a nut on the central post, and the lower end of the end milling cutter can thus be arranged to project past the edge of the cam, to avoid leaving burrs. For cutting the cam shown, the spindle speed is 453 r.p.m., and the total time required is approximately 7 min., the cam blank having previously been roughly shaped. Where a roughing cut is required, a cutter of $\frac{7}{16}$ in. diameter is employed for the first pass, and a ½-in. cutter is then substituted, for the finishing operation.

AUTOMATIC MILLING OF THREE-DIMENSIONAL CAMS

After a cam of modified form has been prepared in this manner for each of the sections of the blade to be machined, production of the cam whereby the form is controlled on the Ex-Cell-O machines can be undertaken. Machining of these 3-dimensional cams, which resemble that seen in Fig. 4 except that they are of solid steel, is carried out on the Pratt & Whitney (Buck & Hickman, Ltd.), type 102, electronically-controlled profile milling machine shown in Fig. 10. Previously described in MACHINERY, 85/968—5/11/54, this machine has an electronic tracer system, and the cams representing the blade sections are employed to control the movements of a milling cutter whereby the required 3-dimensional form is machined automatically. The machine has a central headstock with a spindle carrying, at the right-hand end, a T-slotted face-plate to which the cam blank to be machined is secured.

The outer end of the cam blank is supported by a tailstock, and a milling head is mounted on the cross-slide of a carriage, which moves on the right-hand end of the bed. Drive to the headstock spindle is taken from a ⅓-h.p. motor through differential gearing, which also drives another shaft projecting from the left-hand face of the headstock casting. This shaft can be seen at *D* in the close-up view of the left-hand end of the machine in Fig. 11, and it drives a mandrel which is supported between centres. On the mandrel is mounted the set of blade cams produced on the tape-controlled machine, and in front of these cams there is a holder for a series of sliding blades, each with a roller to contact the corresponding cam. Each blade is held lightly against its cam by a tension spring, and its outer end is machined to a knife edge.

Held magnetically against the knife edges is a thin spring-steel strip *E*, known as a flexure, and this strip is caused to take up curves corresponding to the shape of the 3-dimensional cam as the separate cams are rotated on their mandrel. To enable accurate results to be obtained from the flexure, the separate cams are so mounted on their mandrel that there is a minimum of twist between one blade section and the next. For this reason,

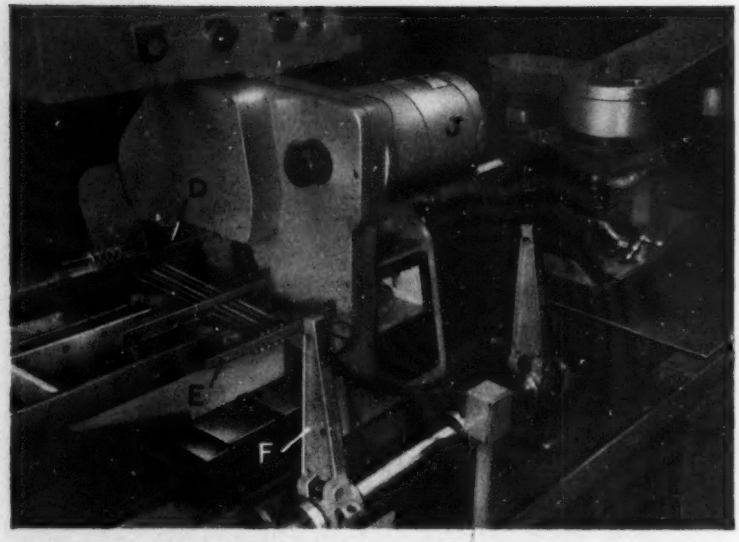


Fig. 11. Close-up view of the Pratt & Whitney machine, showing the spindle *D* on which the cams are mounted. Spaces between the cams are faired-in by a thin spring-steel flexure *E* which is held in place magnetically

each of the datum lines provided on the drawings, to which earlier reference was made, is parallel with a tangential line joining the two highest points on the concave side of the modified cam outline. The required degree of twist in the 3-dimensional cam is introduced during machining by another mechanism, as will be explained.

In front of the flexure *E*, there is a stylus, carried at the upper end of an arm *F*, and this arm is mounted on a bar which carries, at the further end, a similar bar connected to the cross-slide for the milling head. The slide is driven through electro-magnetic clutches, and the supply of current to these clutches is varied by the size of a spark gap between the stylus point and the earthed flexure *E*. This gap is maintained at 0·001 in. by the clutches which move the cross-slide and the stylus in the appropriate direction whenever the size of the gap is changed as a result of the rotation of the cams. With this system, there is no contact between the stylus and the flexure, and the latter cannot be distorted by mechanical loading.

The amount of twist to be imparted to the 3-dimensional cam is controlled in a somewhat similar manner with the aid of the equipment shown in Fig. 12, which is mounted at the rear of the machine and moved by the cutter head carriage. From data supplied by the customer, the amount of twist required at each blade section is determined, and the positions of a series of adjustable blades in the holder *G* are set accordingly, with the aid of a special micrometer fixture. These blades, too, are knife-edged and a flexure is employed to fair-in

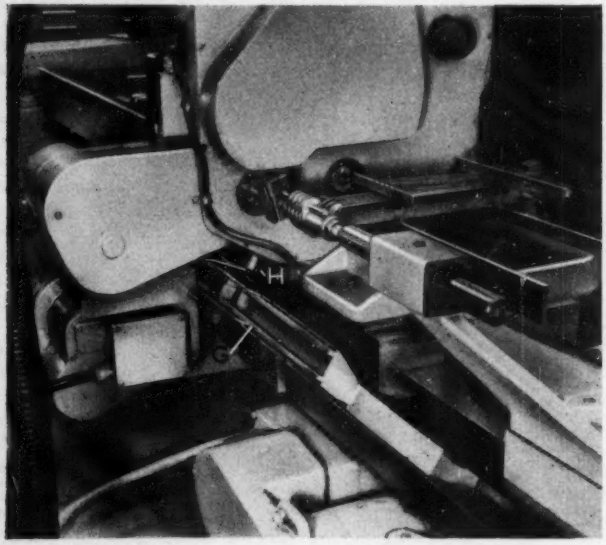


Fig. 12. In this rear view of the Pratt & Whitney machine the adjustable blades in the holder *G*, which control the amount of twist imparted to the 3-dimensional cam, are clearly seen

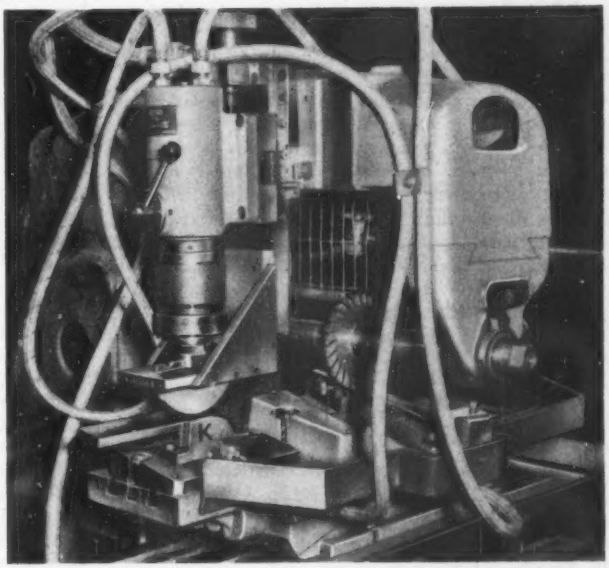


Fig. 13. For milling the root fillet radii between the platform faces and the aerofoil portions of certain blades, this Bridges Copymil attachment is employed. A separate set-up is required for the corresponding operation on the concave side

their edges to a smooth curve, as before. A 0·001-in. spark gap is maintained between the end of the stylus *H* and the flexure surface, and the stylus is carried on the end of an inclined shaft which passes through the headstock casting. On this shaft, there is a circumferential rack, and when the shaft is moved axially, by a pinion driven by the small servo-motor *J*, Fig. 11, the stylus is moved towards or away from the flexure by the distance required to maintain the gap.

Axial movement of the shaft carrying the stylus serves to vary the coupling between the main spindle carrying the cam blank which is being milled, and the shaft *D*, Fig. 11, carrying the modified cam segments, through the action of the differential gears within the headstock casting. In this way, the required angular displacement of the work relative to the controlling aerofoil section cams is obtained, and the necessary twist is imposed. With the set-up shown, the milling head is fitted with a 16-tooth cutter of 2⅞ in. diameter, with a ground form-relieved radius of 0·061/0·063 in. Drive from the 3-h.p. motor is transmitted through serrated V-belts and a steplessly-variable gearbox, and the spindle speed employed is 110 r.p.m. The work is rotated at approximately 1 r.p.m., and the feed rate is such that the milling head carriage traverses the 5½-in. length of the work in about 2½ hours.

Both roughing and finishing cuts are normally taken. The blank is usually cylindrical originally, and a finishing cut of 0·040 to 0·050 in. ensures a good surface finish on the completed cam. Diameter of the work cam is abitrary, but as a rule it does not exceed 6 in.

COPY-MILLING OPERATIONS ON BLADES

In the second of the articles already published in this series, details were given of certain special cam-controlled milling machines designed for the machining of the root fillet radius between the platform face and the aerofoil section. Another method which has been developed for this operation, to enable much simpler and cheaper cam forms to be employed for small numbers of blades, involves the use of a Copymil milling attachment made by S. N. Bridges & Co., Ltd. A view showing a typical set-up on a Werner (Rockwell Machine Tool Co., Ltd.) horizontal milling machine is given in Fig. 13, and it will be seen that the equipment includes a T-slotted table whereon is mounted a fixture to carry the blade, and a cam *K*, which determines the form machined at the blade root. The cam has a flat surface, on the side nearest to the camera, to control the run-in before milling of the fillet is begun.

Beneath the table, there is an intermediate wedge-shaped slide, which is supported on a base clamped to the machine table proper. During the milling operation, the base and table are held in a fixed relationship in the end-wise direction and vertical movement of the table, relative to the base, is obtained by means of a horizontal hydraulic cylinder. Oil supply to this cylinder is controlled by a Copyrite hydraulic valve mounted on a vertical surface on the side of the machine over-arm, with provision for vertical adjustment and clamping. The plunger of this valve projects downwards, and is fitted with a semi-circular stylus of the same diameter as the milling cutter. At the beginning of the operation, this stylus rests on the flat portion adjacent to the cam form and the feed to the main machine table is then engaged.

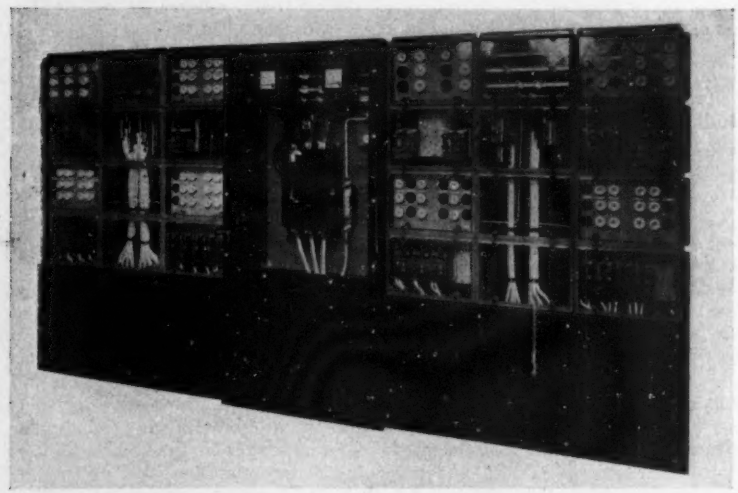
While the operation is in progress, the wedge-shaped slide is moved horizontally to vary the height of the work above the table in accordance with the shape of the cam. For the operation illustrated, a 6-in. diameter cutter of special form, with 26 teeth, is run at 48 r.p.m., with a feed rate of 3¾ in. per min., and mills the convex side of the aerofoil section. Another machine fitted with a similar attachment is employed for the concave side of the aerofoil, and the portions of the root fillet adjacent to the leading and trailing edges are finally blended in by hand. Pressure oil for the operation of the copying attachments is supplied from a self-contained motorized unit located on the floor at the side of each machine.

Klockner-Moeller Switchboards with Transparent Covers

Unit type switchboards with transparent covers, as shown, are now being made by Klockner-Moeller England, Ltd., 7 Charterhouse Buildings, Goswell Road, London, E.C.1. Available for floor or wall mounting, with busbar ratings of 100, 200, 400 and 600 amp., they are stated to be particularly suitable for installation in foundries.

Since the covers are made from transparent material, the electrical equipment can be readily inspected for faults. Bayonet type fasteners are fitted which enable the covers to be quickly removed, if required, for maintenance purposes. The switchboards are claimed to be dust-tight and splash proof, and the material used for insulators has a high resistance to impact and good mechanical strength. By reason of the unit form of construction, the switchboards can be readily extended if required. Provision is made for the connection of rising cables to the factory-wired switch-gear units from all sides of the switchboard.

The company has also introduced recently a range of heavy-duty multi-motor control and re-distribution panels, which are suitable for wall or floor mounting, and are of dust-tight and splash-proof construction.



Example of a Klockner-Moeller Switchboard with Transparent Covers

HELISYN POSITION CONTROL UNIT. At the forthcoming Electronic Computer Exhibition, which is to be held at Olympia, London, from November 28 to December 4, the exhibits of The British Thomson-Houston Co., Ltd., Rugby, will include a working model to demonstrate the Helisyn position control.

This control equipment, which is still in process of development, will provide for precision linear positioning in response to a numerical input, and is particularly intended for application to machine tools and automatic inspection equipment. It comprises a short cylindrical part which can be moved along—but is not in contact with—a longer cylindrical part, each portion being provided with conductive paths which are in the form of interlaced helices.

One of the elements is excited electrically by suitable voltages set up in accordance with the input number, and a misalignment signal is electrostatically induced in the other element.

Laboratory apparatus, which will be on view, will be arranged to accept decimal input defining a position to 0·0001 in., and to show that the combination of digital/analogue converter and Helisyn may be used for mechanical positioning "to an order of accuracy consistent with that of the input." It will also be shown that the Helisyn is sensitive to relative rotation of its elements. This feature, although not essential for the functioning of the system, is of advantage, for example, for setting the mechanical datum.

Developments by Georg Fischer

There has recently been a number of interesting new developments in connection with the +GF+ copying lathes built by Georg Fischer, A.G., Schaffhausen, Switzerland, for whom the selling agents in this country are Vaughan Associates, Ltd., 4 Queen Street, London, W.1. Extensive investigations are in progress relating to the use of ceramic tipped tools, and the type KDM-11/40-C lathe has been introduced specially for turning operations with this cutting material. This machine has been developed from the standard KDM-11/40 design, and has the same capacity, the maximum diameter that can be turned being 9 in. and the maximum length 16 in. A motor of 30 h.p. is fitted in place of the usual 20 h.p. unit, however, and the spindle drive mechanism has been modified to provide speeds ranging from 224 to 2,800 r.p.m., whereas the speeds of the standard machine range from 140 to 1,800. Moreover, the machine structure has been specially strengthened to provide still greater rigidity.

Clutch members, of pearlitic grey cast iron, are now being machined on a KDM-11/40-C machine, and a sectional view of the workpiece is shown in Fig. 1. Previously, the part was machined with a tungsten carbide tool, and the cutting time was

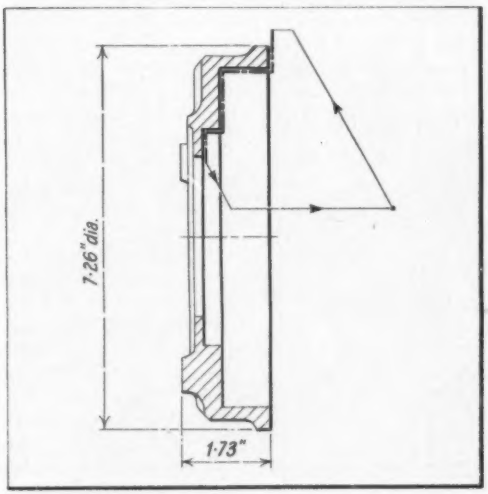


Fig. 1. A clutch member machined with a ceramic tool on a +GF+ KDM—11/40-C lathe in 0·39 min.

COMPARISON BETWEEN THE CUTTING CONDITIONS FOR MACHINING PEARLITIC CAST IRON ON A +GF+ TYPE KDM-18-28/F COPYING LATHE WITH TUNGSTEN CARBIDE AND CERAMIC TOOLS

	Tungsten carbide	Ceramic
Spindle speed (r.p.m.)	63	250
Feed rate (in. per rev.)	0·007	0·007
Cutting speed (ft. per min.)	288	1,148
Tool life (number of pieces)	6-8	25-37
Floor-to-floor time (min.)	20-25	5-8

3·3 min. By using a ceramic tool, the cutting time has been reduced to 0·39 min., and 200 pieces can be machined with one cutting tip, which has four cutting edges at both top and bottom. A spindle speed of 1,400 r.p.m. is employed, and the maximum and minimum cutting speeds are 2,690 and 1,080 ft. per min. The feed rate for surfaces parallel with the machine axis is 0·007 in. per rev., and for surfaces normal to the axis 0·006 in. per rev.

A standard KDM-18-28/F lathe has also been used for machining brake drums of pearlitic cast iron. The drums have a diameter of 17·3 in., and are delivered to the lathe in the semi-finished condition. Finishing on the KDM machine is carried out principally to provide a clean braking surface and to produce a location seating of 220 mm. (8·6614 in.) diameter to H7 limits (−0, +0·0018 in.). Previously, two machines equipped with carbide tools were employed for the finishing operation, but by using ceramic tools on the KDM-18-28/F lathe it has been possible to reduce the time per piece by approximately 75 per cent. A comparison between the speeds and feeds employed with carbide and ceramic tools is given in the accompanying table. It may be mentioned that one of the difficulties encountered when carbide tools were employed was that the braking surface of the drum could not be readily machined parallel, on account of the rapid wear of the tool tip. This difficulty was eliminated when ceramic tools were used, due to their slower wear rate.

IMPROVED TRANSFER MECHANISM

In Machinery, 91/1373—13/12/57, reference was made to two +GF+ type KDM 7/50 copying lathes which were coupled together by means of a conveyor, so that steering worm shafts that were partly machined on the first, could be automatically

transferred to the second, whereon the turning operations were completed. The workpieces were loaded into the magazine chute of a type LEV-7 automatic loading unit on the first machine, and at the end of the first cutting stage were ejected into a chute. This chute was of a curved form, and each workpiece was thus turned, end for end, before it was delivered to the pick-up station of the conveyor, at the rear of the first machine. On the conveyor, the workpieces were supported by pairs of dogs on the twin feed chains. The conveyor sloped upwards from the first machine to the second, and the workpieces were ejected from the top of the conveyor into the LEV-7 loading unit of the second lathe.

The arrangement is shown schematically in Fig. 2, and it will be appreciated that the transfer system can be applied to more than two machines if necessary. Either forgings or billets cut from bar material can be handled, provided that they have been centre-drilled at each end, and that they have been faced to length within a tolerance of ±0·04 in. The maximum and minimum work diameters that can be handled are 3·54 and 0·39 in., and the maximum and minimum lengths 17·7 and 2·75 in.

A re-orientating mechanism of improved design has now been developed, and is shown in Fig. 3, where certain covers and guards have been removed. When the tailstock of the first machine is withdrawn at the end of the cutting cycle, the workpiece drops into a vertical chute, the lower end of which is indicated at *A* in Fig. 3. Adjustably mounted at the rear of the machine bed is a hydraulic cylinder *B*, and below the cylinder support there is a rotatable sleeve member *C*. Pivoted at the bottom of the sleeve is an arm *D*, which has a work-carrying trough *E* at its outer end. The trough is of arcuate cross-section with wings at each end, and between the wings and the bottom of the trough there are slots for the passage of the two conveyor chains.

A sliding member is fitted to the lower end of the piston rod of the cylinder *B*, in which is mounted a cross-shaft with a freely-rotating roller. This roller engages a dog-leg slot *F*, cut in the sleeve *C*. The sliding member also carries a rotatable plate, and this plate is extended at one side to form a lug, which pro-

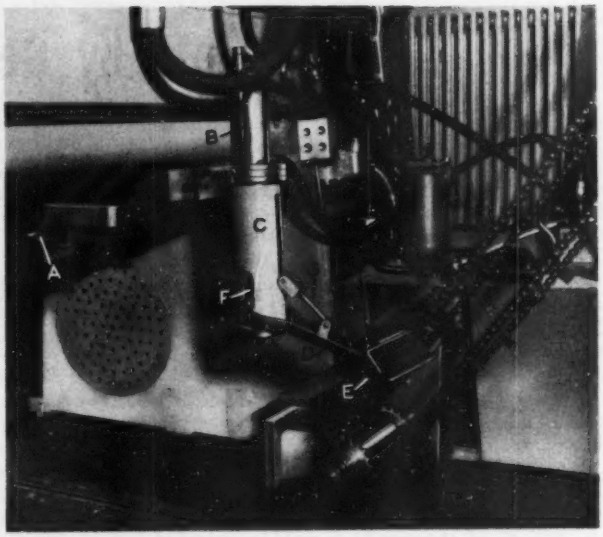


Fig. 3. This improved re-orientating mechanism has been developed for use with the transfer equipment which is shown schematically in Fig. 2

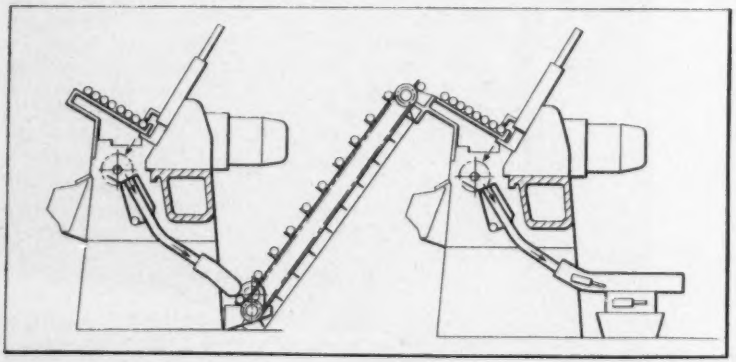


Fig. 2. Diagrammatic layout of the transfer arrangements employed for delivering partly machined workpieces from one +GF+ KDM—7/50 hydraulic copying lathe to the next

jects through a straight slot in the sleeve *C*. Hinged to the lug is a connecting rod *G*, and this rod is coupled to the transfer arm *D*.

The arrangement is such that, when pressure oil is supplied to the lower end of the cylinder *B*, the piston and the sliding member on the piston rod are raised, and, through the connecting rod, the transfer arm *D* is lifted clear of the conveyor chains. As the piston continues to rise, the roller on the sliding member enters the angular portion of the dog-leg slot *F*, and the sleeve is caused to turn, swinging the arm through 180 deg. At the end of this rotary movement, the trough *E* is located beneath the end of the chute *A*, and it is lifted to a position in line with sloping guide members at the bottom of the chute when the roller enters the upper vertical portion of the dog-leg slot *F*. The trough is held in this position, and, at the end of the cutting cycle, a workpiece is ejected into the chute, and passes downwards into the trough *E*. Pressure oil is then applied to the upper end of the cylinder *B*, and the trough is lowered and turned through 180 deg. to the position shown in Fig. 3, thus turning the workpiece end for end. In this position, dogs on the conveyor chains engage the workpiece and carry it upwards, clear of the trough, which is then returned to the position at the bottom of the chute *A*, in readiness for the next transfer cycle. Electrical interlocking arrangements are incorporated to stop the operation of the first machine when the magazine chute of the second copying lathe is full of workpieces.

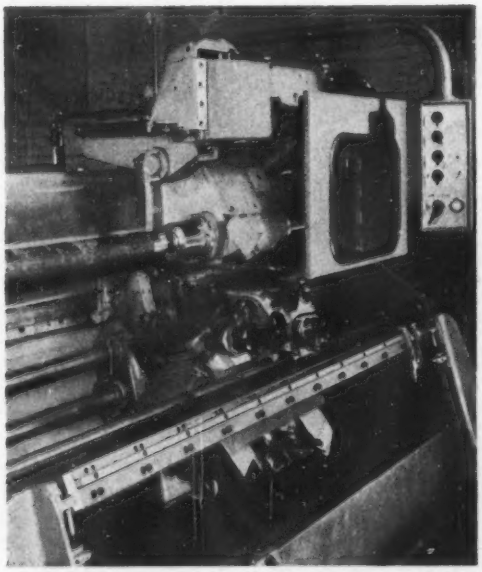


Fig. 4. The thread chasing attachment which has been developed by Georg Fischer, in conjunction with Tarex S.A., for use on +GF+ copying lathes

THREAD CHASING ATTACHMENT

In order to extend the scope of their copying lathes, the Fischer company have developed a thread chasing attachment, in close collaboration with Tarex, S.A., Geneva. Designated type GSA-18, the attachment is shown in Fig. 4, mounted on a type KDM-18/150 copying lathe. On this machine, the thread chasing motion is engaged by hand, but on other +GF+ lathes, it can be initiated by means of trip dogs and microswitches, incorporated in the standard cycle control equipment. The attachment does not interfere with the normal copy-turning operations, and, under certain conditions, it is possible to cut threads while turning is in progress. Standard in-feed attachments can also be mounted on the machines, and can be used for forming undercuts at the ends of the threads to be cut.

Mounted on the vertical bedways of the machine, the attachment is normally held clear of the workpiece by a powerful tension spring, and is swung downwards into the working position by the action of a hydraulic cylinder. In this position, it is supported by a cam which contacts a flat guideway on the body of the tailstock unit, the latter being of a special design for use with the thread chasing attachment. The tailstock and the drive take-off unit are the only additional items of equipment that must be fitted to the machine when the thread chasing attachment is employed. Power is transmitted from the left-hand end of the main spindle of the machine, by a timing belt drive, to a long shaft coupled to the gearbox of the attachment. Change gears in the attachment provide for cutting threads of a variety of pitches. A pendant control panel, seen at the right in Fig. 4, incorporates switches for controlling the attachment, and for engaging different spindle speeds.

The attachment can be used for cutting external or internal threads, and is usually brought into operation at the end of the turning traverse in order to avoid any risk of distortion of the copy-turned surface. Metric, Whitworth, pipe and special threads (including square, Acme, knuckle and buttress, types), of right- or left-hand, can be cut. The beginning of the thread must lie within 5·7 in. of the tailstock end of the workpiece, and the maximum length of thread depends on the pitch. Threads with pitches ranging from 0·04 to 0·24 in. can be produced, the maximum thread lengths for

these pitches being 1 and 2·2 in. respectively, but the greatest length of thread that can be cut is 2·4 in., for a pitch of 0·1 or 0·12 in. The minimum diameter of thread that can be cut is 1·2 in. and the maximum 4·7 in. The thread chasing tool can make a maximum of 60 cutting strokes, and the last three strokes are always made with the tool at the same radial setting relative to the work, in order to finish the thread within close limits for diameter. A sheet-metal guard with a transparent panel is fitted to the attachment to prevent the scattering of swarf.

AUTOMATIC TRANSFER LINE

Automatic universal equipment has recently been designed and built for loading and unloading +GF+ lathes, and the standard units can be readily adapted to handle a wide variety of work-pieces by fitting different work-holders. The basic equipment is known as the ULA-11 universal automatic loader, and has recently been fitted to six type KDM-11/70 copying lathes, which have been linked by conveyors to form two independent automatic transfer machining lines. A diagrammatic layout showing the arrangement of the machines is given in Fig. 5, and it will be observed that the machines in each line are positioned on alternate sides of the conveyor, and that the lines are "interlocked" for economy of floor space. Since the two lines are similar in layout and function, only one will be described.

The line provides for machining main transmission shafts for motor-cars, from forged blanks, and the blanks are delivered automatically to the head of the conveyor track from a centre-drilling and facing machine. The conveyor track consists of three power-driven sections, as indicated at *G*, and three gravity-feed sections, as at *H*. To facilitate positioning and removal, the power-driven conveyors are mounted on trolleys, and a gravity-feed section is hinged to the lower end of each.

Fig. 6 is a general view of the machining line, from a position in front of the first machine, and the first power-driven section of conveyor may be seen at the left. The conveyor consists of two parallel roller chains, which are spanned by a series of steel slats, and each slat carries two brackets with V-shaped seatings to support the workpieces. Both chains are moved together, intermittently, by the action of a ratchet mechanism, a close-up view of which is given in Fig. 7. A ratchet wheel *J* is keyed to the shaft that carries the upper pair of conveyor sprockets, and on an extension of this shaft, a free lever *K* is mounted. The lever is coupled to the air cylinder *L* and the drive pawl *M* is pivoted at its outer end. When pressure air is directed to the lower end of the cylinder *L*, the drive pawl turns the ratchet wheel in a clockwise direction (as viewed in Fig. 7) to move the con-

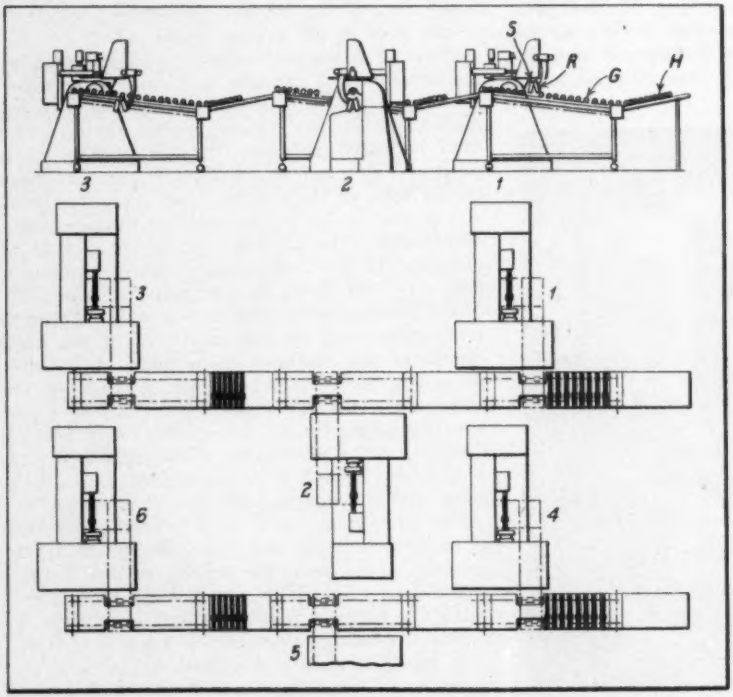


Fig. 5. Diagrammatic layout of two transfer lines each consisting of three +GF+ KDM−11/70 copying lathes linked by conveyors, and provided with automatic loading equipment



Fig. 6. General view of one of the automatic transfer lines shown in Fig. 5, which incorporate three +GF+ copying lathes, and provide for the machining of main transmission shafts for motor car gearboxes

veyor chains through a distance equivalent to the pitch of the slats and work-supports. The lower pawl *N* prevents the ratchet wheel from moving in the reverse direction when air is admitted to the upper end of the cylinder. As may be seen in Fig. 6, guide plates are mounted at either side of the power-driven conveyor to ensure that the workpieces are positioned correctly on the supports.

Workpieces are fed from the head of each power-driven conveyor into a gravity feed section, one of which is indicated at *P* in Fig. 7. To prevent slewing of the workpieces as they pass downwards, each gravity-feed section incorporates pairs of dogs, each pair being mounted on a common shaft, pivoted in the side members of the conveyor frame. The arrangement is such that, as a workpiece is delivered to the gravity-feed section, it contacts the first pair of dogs which hold it in the correct alignment, and then swing forward to release it to the second pair. This action is repeated until the workpiece reaches the bottom of the gravity-feed section, where it is picked up, as required, by the next power-driven section. If the lathe served by this power-driven section is stopped for any reason, the powered conveyor is inoperative and workpieces are stored in the gravity-feed section. When the latter section is full of parts, each supported by a pair of dogs, a trip at the upper end of the section is depressed, and, through associated switchgear, the preceding conveyor and lathe in the line are stopped.

Workpieces are transferred to each copying lathe from a position about two-thirds of the way along each power-

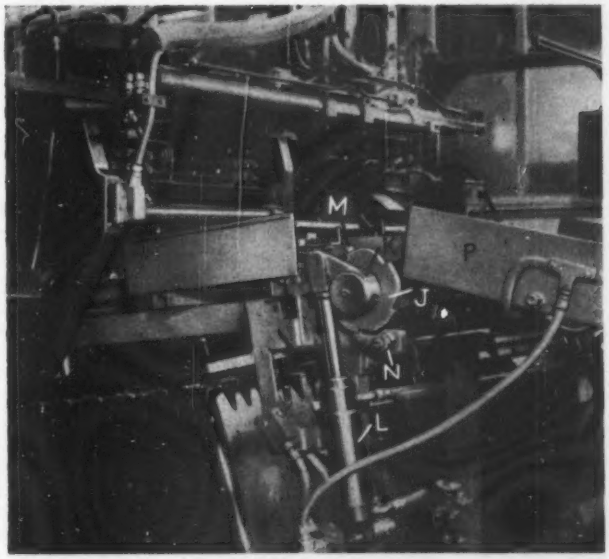


Fig. 7. The head of a power-driven conveyor showing the air-operated ratchet mechanism whereby the work-carrying chains are moved intermittently

driven conveyor. The transfer mechanism is air operated, and is mounted above the machine. Referring to Fig. 6, a platform is secured to the machine headstock and has horizontal slideways whereon a short vertical column can be moved from front ot rear, and vice versa, by an air cylinder. This column has vertical guideways for a sliding carriage, which can be raised and lowered by an air cylinder, and to the front of the carriage is fitted a long horizontal guideway with a narrow traversing platen. The platen is coupled to a long-stroke air cylinder, and T-slots in its lower face provide for the attachment of work-carrier units.

In the close-up view, Fig. 8, the platen is seen at the extreme left-hand end of its traverse, with the column and vertically-moving carriage in their forward and lowermost positions, respectively. The work-carrier unit has a pair of cranked arms, braced by a tubular cross-member, which are spaced so that they can pass on either side of the power-driven conveyor. At the lower end of each arm, there is a pair of air cylinders, and a cylinder of the nearer pair is just visible at *R*. Each cylinder is set at an angle of about 10 deg. to the vertical, as indicated at *R* and S in Fig. 5, and the piston rods of all four cylinders are fitted with steel blades, with V-shaped notches, to support the workpieces. The blade on the cylinder *R*, and the corresponding unit on the other side of the conveyor, provide for supporting incoming workpieces, and the blades on the other two cylinders (*S*, Fig. 5) support the outgoing pieces.

At the start of each transfer cycle, the incoming components—either centred and faced forgings or partly-machined shafts—are lifted by the air cylinders clear of the transfer ways. The carriage on the vertical column fitted to the machine headstock is then moved upwards, lifting the complete horizontally-moving assembly, so that the loaded work-carrier is raised clear of the conveyor. With the horizontal slideway fully-raised, air is directed to the left-hand end of the long-stroke air cylinder and the work carrier is then traversed until it is in line with the machined workpiece held between the headstock work-driver (or chuck) and the tailstock centre. The carriage is next lowered on the vertical column, and the column is then traversed towards the rear of the machine.

At the end of this cycle of movements, the incoming workpiece is positioned below and slightly in front of the workpiece in the machine, and the empty V-supports on the other pair of cylinders of the work-carrier (*S*, Fig. 5) are located below and slightly to the rear of the machined part. Air is then applied to the lower ends of these latter cylinders, so that the associated supports are raised to engage the machined workpiece, before the air-operated centre of the tailstock is retracted, and the workpiece is pushed clear of the headstock driver by a spring-loaded centre. Next, air is directed to the upper ends of the supporting cylinders, and the machined workpiece is lowered. Once this workpiece is clear, the incoming workpiece is raised by its supporting cylinders, until the centre-holes at either end are aligned with the headstock and tailstock centres of the machine. The air-operated tailstock centre is then advanced, thrusting the incoming workpiece endwise, against the pressure exerted by the spring-loaded headstock centre, until the end of the workpiece engages the driver jaws.

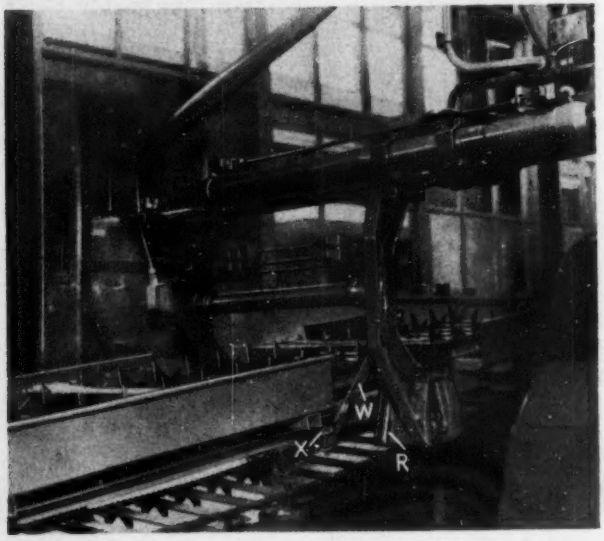


Fig. 8. Close-up view of the work-carrier of the automatic loading mechanism which delivers an unmachined workpiece to the lathe and removes a turned component

With the incoming workpiece supported by the headstock driver and the tailstock centre, the vertical column of the transfer unit is moved to its position at the front of the machine, the machined workpiece passing below the piece that has just been loaded. At the end of the forward movement, the carriage on the column is raised, lifting the horizontal sliding assembly and the machined

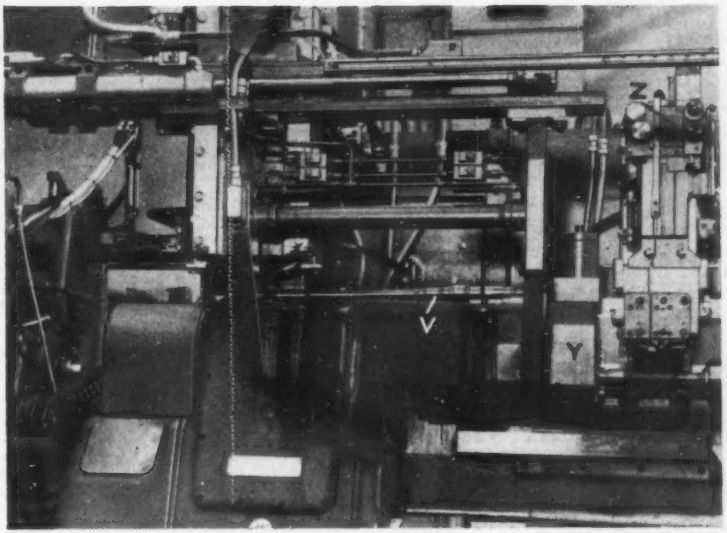


Fig. 9. The work-carrier of the automatic loading mechanism is here seen after it has delivered an incoming workpiece to the machine and removed a turned part in readiness for transferring it to the conveyor

workpiece into the setting shown in Fig. 9, where the component is indicated at *V*. The horizontal motion is next engaged, and the work carrier is traversed to the position above the power-driven conveyor. Next, the carriage is lowered on the vertical column, and as the horizontally-moving assembly and work carrier are moved downwards the machined workpiece is deposited on a pair of supports on the conveyor. The work carrier remains in the lowered setting while the intermittent motion of the conveyor is engaged, and the machined workpiece is carried clear and a forging (or partly machined piece) is advanced into its place, in readiness for the next loading and transfer cycle. The complete sequence of movements that has been described occupies only 0·15 min.

As each forging or workpiece is moved into the pick-up position, it depresses a lever *W*, Fig. 8, thereby closing a limit switch *X*. If the lever is not depressed, and the switch remains open—thus indicating that there is no part at the pick-up position—the horizontal traverse of the loader cannot be initiated, and the machine is stopped. Similar interlocking arrangements are incorporated for all phases of the operating cycle, and the loading and transfer sequence is initiated, and the cutting cycle is started, by trip dogs on the normal cycle control panel of the machine. When necessary, however (for example, when setting up), the various motions can be engaged individually by toggle switches on a pendant control panel at the tailstock end of the machine. This panel is seen in the close-up view, Fig. 10, and it will be observed that it has a diagrammatic layout of the loading mechanism, with the various functions indicated by arrows.

CUTTING OPERATIONS

The sequence of cutting operations is indicated schematically in Fig. 11. For all three machining stages, the workpiece is supported by a 3-point roller steady, since its diameter/length ratio is 1:15, approximately. This

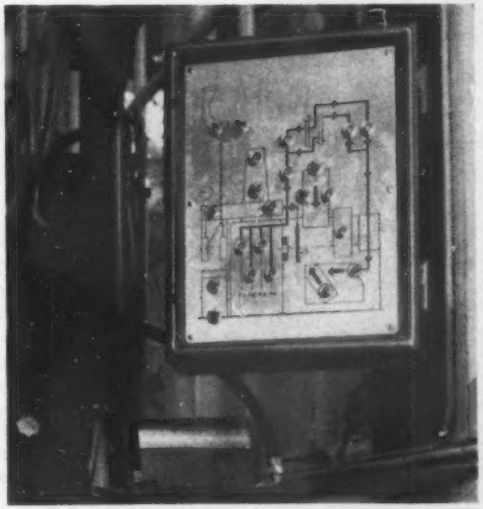


Fig. 10. Close-up view of the control panel mounted on a pendant at the tailstock end of each of the +GF+ KDM−11/70 copying lathes. The panel incorporates a functional diagram

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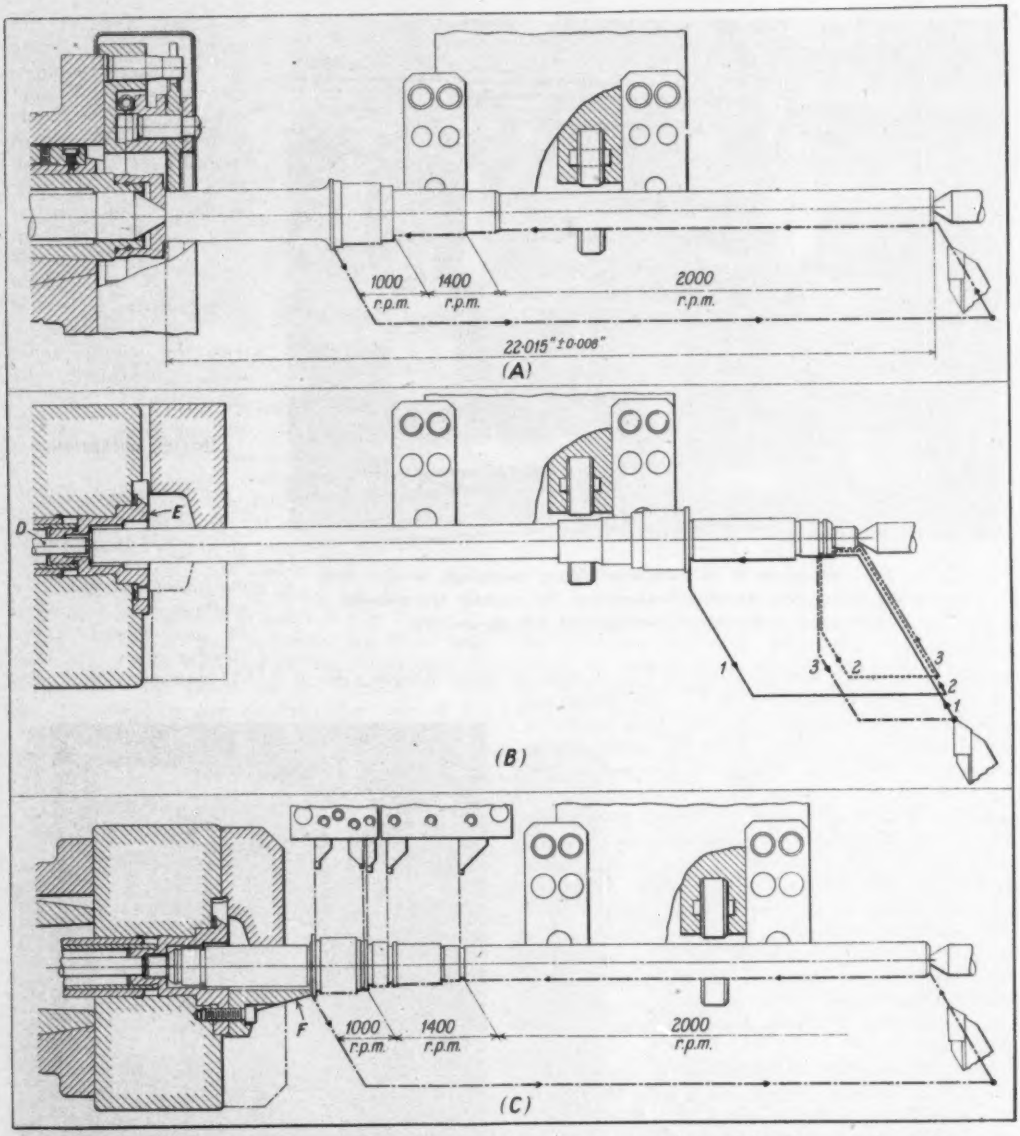


Fig. 11. The three operation sequences performed on the automatic transfer line are here shown diagrammatically. Faced and centre-drilled blanks are delivered to the first machine, and finish-turned transmission shafts are removed from the last machine at a rate of 37 per hour at 80 per cent efficiency

steady does not interfere with the loading operations since the rollers are in the 9, 12 and 3 o'clock positions. The gravity-feed conveyor leading to the first KDM-11/70 lathe from the centring and facing machine—to be supplied by Douglas Fraser & Sons, Ltd., Arbroath—holds a stock of forgings sufficient to allow the first lathe to run for a period of 20 min.

As indicated at *A* in Fig. 11, a simple copying cut is taken on the first lathe, and the spindle speed is changed at two positions along the length of the piece, in order to maintain the cutting speed between 340 and 480 ft. per min. The speed changes are effected automatically by electro-magnetic clutches, actuated by limit switches which are tripped by dogs on the standard cycle-control panel at the rear of the machine bed. A constant cutting feed of 0·019 in. per rev. is employed, and the cutting time is 1·15 min.

The cutting operations performed on the second lathe are shown diagrammatically at *B*, in Fig. 11. By arranging the second machine on the side of the transfer conveyor opposite to the first (as shown in Fig. 5), the end of the workpiece that is machined at the first stage is automatically presented to the chuck for the second stage, and the need for a re-orientating unit is avoided. The chuck fitted to the headstock spindle of the second lathe is provided with hardened jaws, and within the chuck is mounted an end stop assembly. This assembly incorporates a spring-loaded plunger *D*, which serves to thrust the workpiece out of the jaws at the end of the cutting operations. During the loading sequence, the tailstock centre is advanced by the action of an air cylinder and thrusts the workpiece endwise, against the pressure exerted by the plunger *D*, until the datum surface at the end of the machined portion contacts an internal face of the location bush *E*. This arrangement ensures that the shoulders machined on the workpiece are in the correct relationship to the end face of the piece. The movement of the tailstock centre initiates the closure of the chuck jaws, through a trip dog and limit switch.

As may be seen in Fig. 9, the second KDM-11/70 machine is fitted with a 3-point steady *Y* and an automatic in-feeding slide *Z*. The copy-turning tool makes three cutting passes, under the control of the automatic re-cycling system of the machine, and the infeeding slide is brought into use at the end of the third pass. In Fig. 11, the path of the copying tool during the first, second and third cuts is indicated by solid, dotted and chain-dotted lines, respectively. A constant cutting feed of 0·014 in. per rev. is employed, but the spindle speed is changed automatically for each cutting pass, also for the in-feeding cut. The first pass is carried out at a speed of 1,000 r.p.m., the second, at 1,400 r.p.m., and the third, at 2,000 r.p.m., and for the in-feeding operations, to form the undercuts, the speed is reduced to 1,000 r.p.m. Surface speeds are thus provided which are approximately the same as for the turning of the long end of the shaft on the first machine. At the end of the operation sequence on the second machine, the short end of the shaft has been completely machined, and the cycle time for this stage is 1·3 min.

As indicated diagrammatically in view *C*, Fig. 11, the work-holding arrangements on the third machine are similar to those for the second stage, and a 3-point steady and in-feeding slide are again employed. On the third machine, however, the workpiece is located endwise by stop members, as at *F*, which are engaged by the flange face machined during the second operation stage. The copy-turning tool makes only one cutting pass, and the in-feeding slide is advanced during the latter part of this traverse, so that the tools mounted thereon machine five undercuts during the return movement of the copy-turning tool. During the copying traverse, the spindle speed is changed, as on the first machine, to provide speeds as indicated in Fig. 11, and a constant cutting feed of 0·014 in. per rev. is employed.

With the set-ups that have been described, 37 shafts per hour are completely turned when the machines are operating at 80 per cent efficiency. If the same shaft is machined on both lines, 1,184 shafts can be produced in 16 hours. Tools tipped with Sandvik Coromant carbide are used throughout, tips of S.2 grade being employed for the first stage, and of S.1 grade for the second and third stages, and the machines can be run for about 2 hours before the tools require to be changed. A copious flow of Ultraline water-base cutting fluid (Ultraline Co., Zurich) is directed on to the tip of each tool by way of a hole in the holder.

The Ultraline coolant, which is green in colour, contains special additives to maintain the temperature at a low value, and its use permits the components to be checked immediately after machining, without any delay to allow them to cool to room temperature. The coolant pump on each machine is interlocked with the mechanism for operating the chuck jaws, and the machine cannot start unless the coolant is being delivered and the jaws are closed. Pressure switches are incorporated to prevent operation of the machines if the pressure of the air supply to the auxiliary equipment falls below a predetermined value. Each machine is fitted with a guard, which can be moved clear of the cutting area on rails, and a limit switch ensures that the automatic cycle cannot be engaged unless the guard is in the correct position. It is planned to incorporate a measuring probe in the gravity-feed conveyor between the first and second machines, which will stop the line if the components delivered from the first machine are not within the prescribed 0·004 in. roughing tolerance. The tolerance on the finished parts is 0·002 in.

The New Raleigh Moped

Claimed to be the first machine of its type to be produced on a large scale in this country, the new moped developed by Raleigh Industries, Ltd., Nottingham, will be available at the beginning of November. Shown in Fig. 1, the machine is the result of design and research extending over two years, and prototypes have been thoroughly tested for more than one year. The tests have included rigorous trials on the M.I.R.A. grounds, and a moped was ridden for more than 4,500 miles in South and East Africa, without design failure. Fuel consumption during this test was 176 m.p.g., and the average mileage 214·7 per day. Other machines have been ridden continuously for more than 30,000 miles, with complete reliability.

The moped has been designed as a basic machine of the simplest type, and care has been taken to ensure maximum ease of operation consistent with performance. It has an engine that has been specially designed by the Sturmey-Archer Co., a subsidiary of Raleigh Industries. Special attention has been paid to simplicity of construction and accessibility of all parts, so that any competent mechanic or moped user can carry out running repairs or decarbonization.

A sectional view of the 2-stroke engine is given in Fig. 2. Of single cylinder design, it has a bore of 38 mm. (1·496 in.), a stroke of 44 mm. (1·732 in.) and a capacity 49·9 c.c. The cylinder has twin transfer ports and a flat topped piston, with a chromium plated top ring and plain bottom ring. Maximum output of 1·3 b.h.p. is obtained at 4,300 r.p.m. The close-grain cast iron cylinder has a detachable aluminium head and the crankcase is also of aluminium. Ball journal and needle roller bearings are provided for the single-sided crankshaft, which is machined from an upset forging, and the connecting rod, made from a steel stamping, has a roller bearing big end and a plain bearing little end. Special attention has been paid to the distribution of lubricating oil. A Lucas flywheel magneto, with lighting coil, and an Amal carburetter, with starting enrichment, are fitted.

The complete engine assembly, including the exhaust system, is secured to the lower frame tube of the moped by four bolts, so that it may be readily removed for servicing.

For cheapness and simplicity, the normal gearbox and clutch have been omitted, and the engine is controlled by means of a decompressor valve and throttle, both of which are actuated by a twist-grip on the right handlebar. The decompressor valve is indicated at A in Fig. 2, and by turning the twist-grip forwards, the valve is opened and compression is reduced to zero, so that the engine can be turned over quite easily. The moped is then pushed or pedalled until a speed of about 4 m.p.h. is attained, and by rotating the twist grip in the opposite direction at this speed the decompression valve is closed, and the engine is started. To stop the machine, the valve is opened, and the brakes are applied. Drive is transmitted by V-belt from the crankshaft to a mainshaft co-

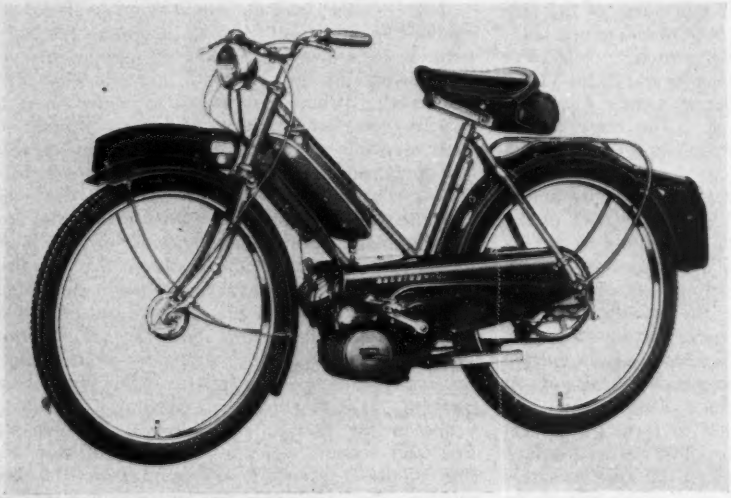


Fig. 1. The new moped which has been developed by Raleigh Industries, Ltd., Nottingham and has a Sturmey-Archer 2-stroke engine

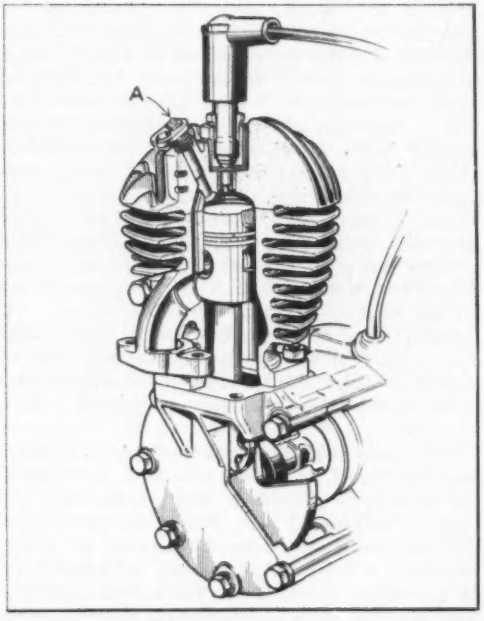


Fig. 2. Sectional view of the Sturmey-Archer engine of the Raleigh moped, showing the decompressor valve *A*

axial with the normal pedal crank-shaft, and, if necessary, the engine can be completely disconnected by withdrawing a knurl-head pin. In this condition, the moped can be pedalled or wheeled as freely as a normal bicycle, although with a much lower gear ratio. The mainshaft is connected to a large sprocket on the rear wheel assembly by roller chain, and another roller chain, with a jockey sprocket, transmits the drive from the pedal crankshaft to a second rear-wheel sprocket.

The low compression ratio of the engine provides good flexibility at low speeds, with ready acceleration, and the power output provides a maximum speed of about 30 m.p.h., with a cruising speed of 25 m.p.h. At the latter speed, the fuel consumption is of the order of 200 miles per gal.

PRODUCTION FACILITIES

To enable the price of the moped to be reduced to a minimum, Raleigh Industries have established fairly extensive production facilities in anticipation of demand. Assembly operations are carried out in a self-contained department, to which parts are supplied from the main works, engines being delivered as complete units. Flow-line methods have been adopted wherever possible, and wheels are built at a series of benches, one of which is seen in Fig. 3. The bench top is divided into a series of compartments to hold spokes, nipples and other components, and, first, the spokes are assembled to one side of a hub unit, after which the spokes of this sub-assembly are passed through alternate holes in a rim, and nipples are fitted. The remaining spokes are then assembled and secured with nipples, which are screwed down finger-tight.

The wheel is next passed to a truing station—seen in the background in Fig. 3—and there is one such station to two wheel-building benches, each building operator producing between 120 and 150 wheels per day. At the truing station, the wheel is supported by its spindle on a slide and the

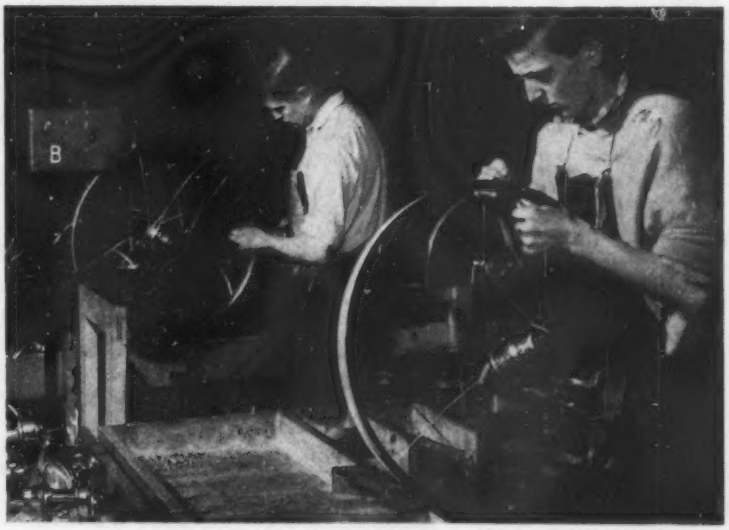


Fig. 3. The wheel-building section of the assembly department for mopeds at the Nottingham factory of Raleigh Industries



Fig. 4. Mopeds are assembled by flow-line methods with the frames mounted on trolleys which can be moved along a U-shaped track

nipples are tightened by an experienced operator until the rim is approximately true, as judged by eye. The slide is then advanced to engage the rim with the truing gauge *B*. This gauge incorporates rollers which bear on the sides and periphery of the rim, and any eccentricity or deviation from truth is indicated by pointers on a scale. Final correction of the wheel is readily performed by adjusting the nipples, after which the wheel is removed and placed in a chute, whereby it is fed to a station for fitting the inner tube and tyre, also, in the case of rear wheels, the sprocket and freewheel unit.

Frames, already finish enamelled, are delivered from the main factory to a U-shaped assembly line in the moped department. At the head of this line, there is a group of three benches, and, at one bench, an operator makes up bottom bracket sub-assemblies, comprising the co-axial spindles, and the associated needle roller bearings, and another operator fits the pulley for the V-belt drive from the motor. A third operator fits the chain stays, which are offset to accommodate the twin driving chains, and rivets a crest on the head of the frame, using a foot-operated press and simple hand tools. At this stage, the bottom bracket in the frame is finish bored with the aid of a simple machine incorporating a Boneham & Turner head.

With this work completed, each frame is transferred to a trolley which is mounted on rails laid on the shop floor, as may be seen in Fig. 4. The vertical pillar of the trolley has a spigot which enters the seat tube of the frame, and assembly continues stage by stage along the U-shaped track, until, on reaching the far end, the moped is almost complete.

The machine is then removed from the trolley and transferred, on its own wheels, to a test station for running-in, adjustment and a noise check. It may be mentioned here that before the engines are delivered to the assembly department, each is subjected to a dynamometer test. A close-up view of one of the stands at the test station is given in Fig. 5. The moped is loaded on to the stand by way of a wood ramp, and its rear wheel rests on a roller, within the guard *C*, its front wheel being supported by a platform-extension of the ramp

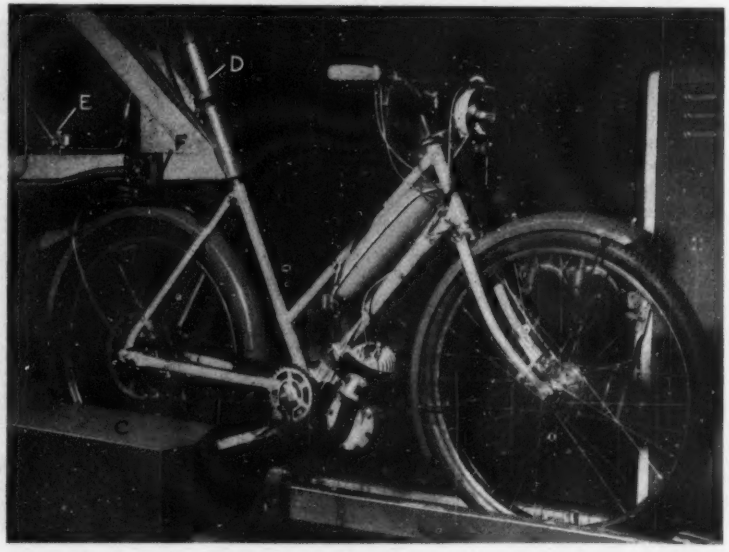


Fig. 5. One of the stands provided for testing Raleigh mopeds before the final stage in the assembly sequence

between wood guide rails. A bracket projects from the framework of the test stand and carries an air cylinder *D*, which is connected to the shop air supply by way of a lever-operated valve *E*. When the valve lever is in the position shown, pressure air is directed to the upper end of the cylinder, and the piston is thrust downwards so that an extension of the piston rod enters the seat tube of the moped to hold it on the test stand.

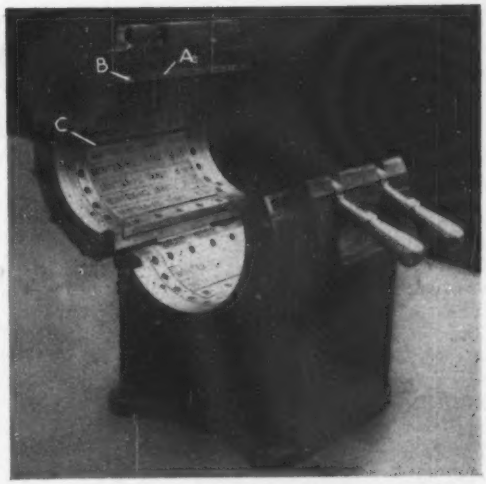
The roller of the test stand can be driven by an electric motor, controlled by the push-button *F*. At the start of the running-in and test sequence, the button is depressed, and the roller drives the rear wheel of the moped. As soon as the engine of the moped fires, the push-button is released and the electrical supply to the motor is cut off. The moped is then allowed to run for a period of 5 to 10 min., driving the roller, which is of considerable weight, and the electric motor.

After the test has been completed, and any adjustments have been made, the moped is removed from the stand, and passed to a further assembly section where the saddle, chain guard, pedals and other parts are fitted. The assembly department has been designed for an output of 1,000 machines per week, and it is expected that this figure will be achieved shortly, although the average output, at present, is about 700 mopeds.

An Air-operated Cylinder Tube Clamping Fixture

Production of all the cylinders, valves, and solenoids which comprise the range of air-operated equipment made by the Maxam Power, Ltd., a member of the Holman Group of Companies, is concentrated in their works at Camborne, Cornwall, and among some of the items of special equipment which this company has developed for the purpose, is the air-operated cylinder-tube fixture shown in the figure. This fixture is used for holding lengths of steel tube during a honing operation. The tubes range up to 12 in. diameter by 12 ft. long, and are cut to form shorter cylinders.

The fixture consists basically of two heavy-section castings in the form of a conventional hinged half-cap bearing. A 1-in. diameter plain rod is used as a hinge for the upper portion, and a pair of eye-bolts is provided to clamp the latter in position when it is closed. The semi-circular portion of each casting is chambered-out to receive a number of rectangular Mintex pads, which are retained, in the cap member, by the steel strips seen at *A* and *B*, a similar arrangement being employed for retaining the strips in the lower casting. It should be noted that the steel retaining strips do not clamp the Mintex pads, the latter being allowed a limited amount of free float in all directions.



An air-operated fixture used for holding long tubes during a honing operation

The end of each pad is stepped and chamfered, in a similar manner to the end of the steel strip *A*, and these formed end portions engage beneath the lips on the semi-circular pieces *B*. A total of ten pads is used in each half-bore, and there is a steel separating piece between the fifth and sixth pads as can be seen at *C*. The thickness of this separating piece is approximately $\frac{1}{16}$ in. less than that of the Mintex pads, so that it cannot come into contact with the outside surface of the clamped tube.

The chamber behind the pads, in both the upper and lower castings, is connected by a drilled hole to an air inlet connection. When a tube has been placed in the lower half of the fixture, the hinged cap is closed and clamped, and compressed air is admitted to the chambers of the upper and lower castings with the result that pressure is applied to the backs of the Mintex pads. Owing to the degree of float which is permitted to the pads, they take up positions such that each has overall intimate contact with the tube, and an even clamping pressure is applied around the full circumference.

The company states that this method of clamping obviates any distortion, and enables a consistent surface finish to be obtained in the bore of the tube. The Mintex pads used, which are supplied by British Belting and Asbestos, Ltd., Cleckheaton, Yorks, are of an asbestos-based material with a proportion of impregnated cotton, and at normal temperatures have a friction coefficient of 0·45.

Centre National des Industries et des Techniques, Paris

The Centre National des Industries et des Techniques (C.N.I.T.), Paris, a project sponsored and financed largely by the various branches of the French engineering industry to provide adequate and up-to-date facilities for holding international exhibitions, is now in an advanced stage of completion, and some 175,000 sq. ft. of stand space was made available for the inaugural Mécanélec exhibition, held from September 12 to 21.

Built on a site near the Place de la Défense at Puteaux on the outskirts of Paris, and readily accessible, the C.N.I.T. is stated to be the largest exhibition hall of its kind in the world. When finished in the near future, it will provide, under one roof, 760,000 sq. ft. of floor space for exhibition purposes, and 320,000 sq. ft. for offices, conference halls, restaurants and other services. As may be seen from the view of a model in Fig. 1, the building provides a striking example of modern functional architecture. The nature of the site at the Place de la Défense dictated a building of triangular shape, to make the best possible use of the ground available, and the design is the result of an exhaustive study by three French architects, Camelot, de Mailly and Zehrfuss. Construction is being undertaken by the French firms, Balency & Schuhl, and Boussiron & Coignet.

The building, which rises to a height of 160 ft. is virtually without walls, and takes the form of three arches of double-skin reinforced concrete construction, combined to form a roof, the sides consisting almost entirely of glass. Fig. 2 is a view of the actual building taken shortly before the opening of the Mécanélec exhibition. The three corners of the building rest on foundations 715 ft. apart, and they are anchored to each other, to prevent outward movement, by underground steel cables in tension. Nearly 190 miles of tubular scaffolding, the erection of which occupied two months, were required in the construction of the roof.

Within this triangular arch are provided floors at five levels, as shown in the sectional diagram Fig. 5, which are constructed almost entirely from pre-fabricated, reinforced concrete sections. The latter were produced in a works occupying 30,000 sq. ft., which was specially built for the purpose.

The concrete floor at the first level, laid on compacted and stabilized earth, has an area of 270,000 sq. ft., of which a little more than 10,000 sq. ft., at the centre, has a clearance under the roof of 150 ft. Over the remainder of the space the clearance varies from 16 to 36 ft. In addition to numerous public entrances, there are three points of access for road vehicles. Part of this floor, extending outside the base of the main triangle of the building, is designed to accommodate the heavier exhibits and is served by a 20-ton crane. The floor at the second level provides an area of 123,000 sq. ft. with a ceiling clearance of 20 ft. It is accessible to the public from outside and there is also an entrance for road vehicles.

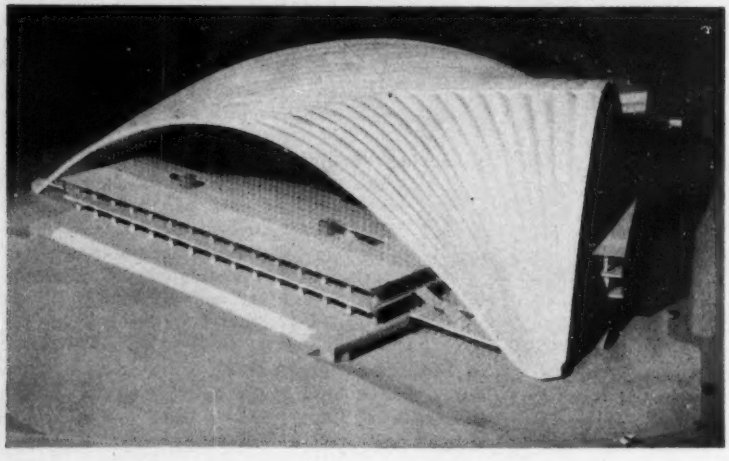


Fig. 1. A model of the Centre National des Industries et des Techniques

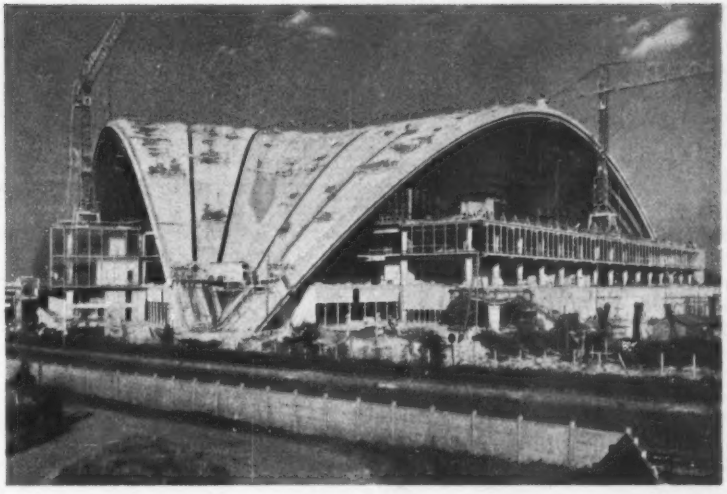


Fig. 2. View of the C.N.I.T. taken shortly before the opening of the Mécanélec exhibition

Regarded as the most important, the third level, which extends for the greatest distance inside the building, has a floor area of 220,000 sq. ft. This level, again, is accessible from outside, and there are two entrances for road vehicles. The ceiling height over the area ranges from 16 to 115 ft., and the floor is of pre-stressed, double-skin construction, as seen in Fig. 3, which is a reproduction of a photograph taken, during the exhibition, from the first level. The termination of the third level floor at the centre of the building forms a hexagon. Prefabricated sections, of the triangular shape, with 20 ft. side, were employed, and between the upper and lower sections there is a space of about 7 ft. to accommodate electric cables and other services, which are thus readily accessible for maintenance. Channels between each upper and lower floor section enable distribution points to be provided for exhibition stands spaced every 16 ft. The support pillars for this third level are 60 ft. apart, and permit a floor loading of 200 lb. per sq. ft. A view, taken from the second level during the Mécanélec exhibition, is shown in Fig. 4. Here may be seen the ceiling formed by the third level.

Floor areas of 75,000 sq. ft. and 70,000 sq. ft. respectively are provided at the fourth and fifth levels, and the ceiling height for each is 16 ft. At levels 2, 4 and 5, the permissible floor loading is 100 lb. per sq. ft. and distribution points for electricity and other services are provided in channels between the supporting pillars, spaced 30 ft. apart. An electricity supply totalling 15,000

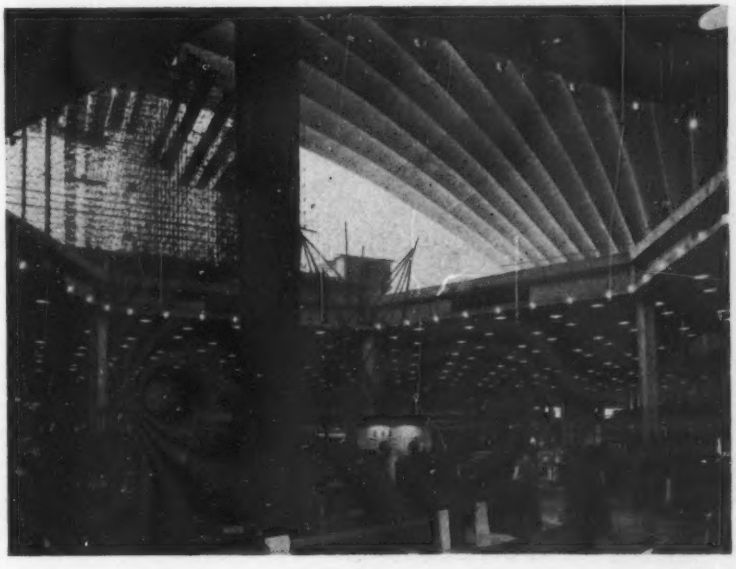


Fig. 3. A view from the inner edge of the first level of the C.N.I.T. building, showing the hexagonal opening formed by the floor at the third level of the structure

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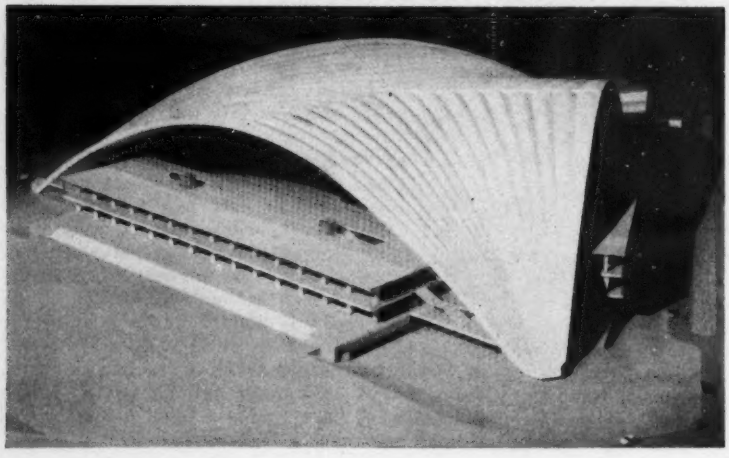


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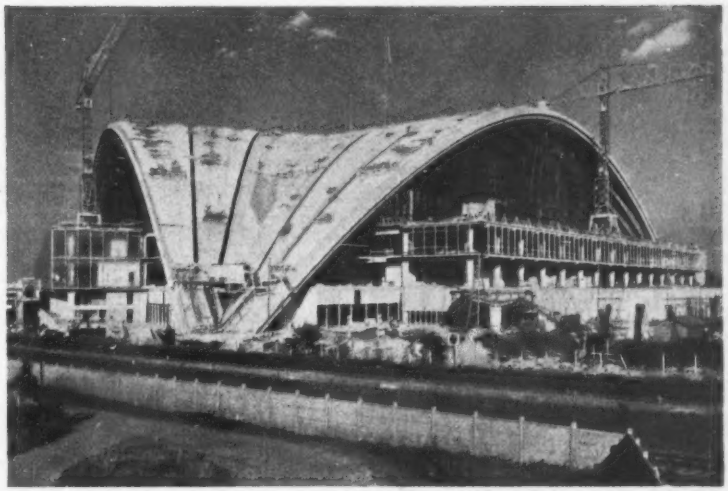


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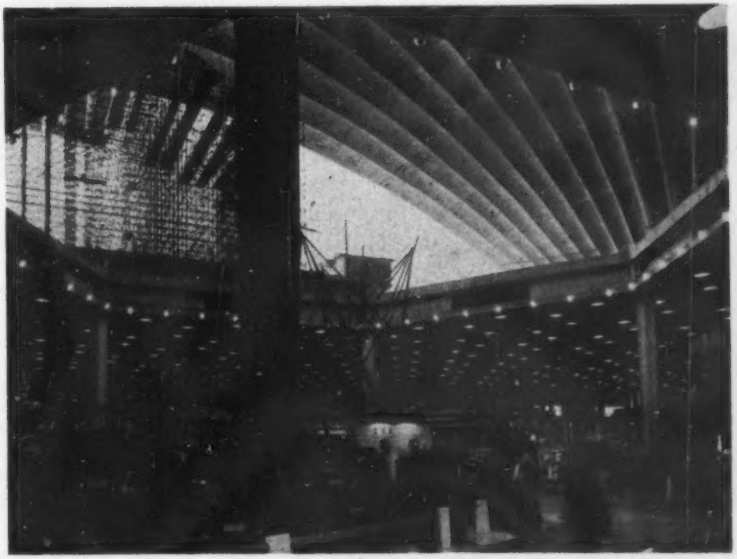


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kVA will be available from six main distribution stations, and there will be adequate supplies of gas, water, and compressed air.

Access from inside the building to the various levels will be afforded by escalators, lifts and staircases located at each of the three sides of the triangle. A large parking space is provided for cars, and there will be facilities for staging open-air exhibits.

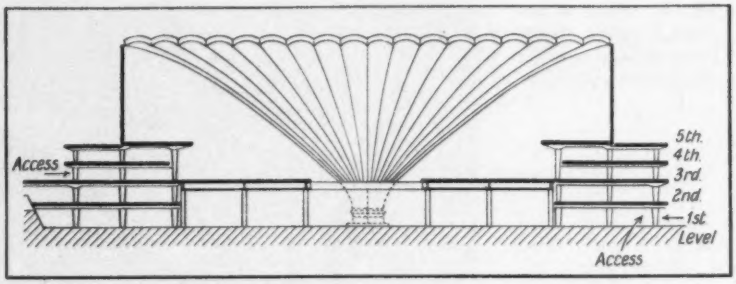


Fig. 5. Sectional diagram showing the arrangement of the five floor levels of the Centre Nationale des Industries et Techniques, Paris

Work on the construction of the C.N.I.T. was started in May, 1956, and as an indication of the progress that has been made, it is stated that, up to the time of the Mécanélec exhibition, more than a million cubic feet of concrete had been poured. The building is scheduled to be ready for full occupation in time for the Sixth European Machine Tool Exhibition to be held next year.

The Mécanélec exhibition held recently to mark the approach to completion of C.N.I.T. was sponsored by the Fédération des Industries Mécaniques et Transformatrices des Métaux (F.I.M.T.M.) and the Syndicat Général de la Construction Electrique (S.G.C.E.). Some 650 firms took part, and the stands, totalling 175,000 sq. ft., occupied the first and second levels of the new building. Machine tools, small tools, gauges, and measuring instruments were prominent among the exhibits, and in addition to the displays of equipment built in France, the products of a number of British, German, Swiss and other foreign firms were shown on the stands of the French agents. Also on view was a large amount of electronic control equipment for a variety of industrial purposes, together with electric motors, switchgear, welding equipment, and power transmission accessories. Reference will be made in a later article to some of the machine tool exhibits which presented features of special interest.

It is proposed to hold a second Mécanélec exhibition in September, 1960, and in this connection it is stated that more than a third of the firms at the first exhibition have already expressed a desire to take part. The large amount of floor space that will then be available will enable facilities to be extended to exhibitors from other countries.



Fig. 4. View of the second level taken during the Mécanélec exhibition. The ceiling is formed by the pre-fabricated reinforced concrete sections of the third level

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STEAM LOCOMOTIVES produced by British Railways and private manufacturers during the second quarter of this year totalled 25, of which 15 were for use on main line railways in the United Kingdom, and 10 were for export.

Die Casting Supplement

Safety Arrangements for Pressure Die Casting Machines

In 1956, the Technical Committee of the Zinc Alloy Die Casters' Association (Z.A.D.C.A.) set up a sub-committee, composed of members experienced in die casting, and including a representative of H.M. Engineering Inspectors of Factories, to study the dangers associated with the operation of pressure die casting machines and associated equipment, and to make recommendations as to the methods whereby these dangers could be minimized or avoided. A recently-issued preliminary report* (on which this article is partly based), gives some of the conclusions reached by the sub-committee, and includes details of certain methods that are recommended for improving the safety of employees in the die casting shop. The main features of the report are here summarized, and some examples are given of effective safety precautions now in force in various leading die casting foundries in this country.

Apart from the normal dangers associated with power operated machinery to be found in most factories, the main risks encountered in the die casting shop are of burns caused by molten metal being forced out from between incompletely-closed die faces, or elsewhere; burns—on cold chamber machines—due to the bursting of slugs, which are still molten internally when the die opens, under the maintained pressure of the injection plunger where it is employed to assist ejection of the slug from the sleeve; and of hands or other parts of the body being trapped and crushed between the die members or the fixed and moving platens due to accidental closing. Other dangers, such as those of fire when a high-pressure hydraulic oil pipe leaks or bursts, will form the subjects of later investigations, and, it is hoped, will be discussed in future articles.

The discharge of molten metal from the dies accounts for about 60 per cent of all the accidents of which details are supplied to Z.A.D.C.A. Many such accidents are not serious, but they may cause more disruption than the mere interruption of production on a particular machine while the burn receives attention, important though the loss of output may be. For instance, discussion of such accidents may result in the process being regarded as one involving a high degree of risk by young potential operators, and there may also be psychological effects on other operators nearby which may slow down or otherwise affect production. Most metal splashes are emitted from between the die faces when they are held apart by accumulations of metal debris or build-up of flash.

Other causes of splashing include mis-alignment of the dies and worn surfaces, and failure of the interlocking arrangements to prevent injection before the dies have fully closed. When such a failure occurs, it is possible for the metal to be injected while the dies are still in the fully-open position.

To avoid the risk of slugs bursting, it is sufficient to arrange for the retraction of the injection plunger before the dies are opened, so that there is no pressure on the slug during the opening movement. At least one large organization in this country operates such machines as the Lester-Phœnix and Peco 10C cold-chamber units in this manner, and experience no difficulties due to slugs sticking.

Injuries due to trapping between the die members or platens are less frequent than burns, but are usually much more serious, and often involve permanent injury to the persons concerned. Such accidents seriously affect production; and may involve either the operator or the setter of a die casting machine. Since guards must be retracted or removed during setting operations, special precautions must be taken to ensure the safety of the setter while he is working between the platens. Guards employed in die casting foundries in this

* Obtainable from Z.A.D.C.A., 34 Berkeley Square, London, W.1.

country vary from simple hand-operated shields, which do not affect the operation of the machine in any way, to more elaborate interlocked types, arranged for operation as part of an automatic machine cycle, as will be described.

Since guarding is the ultimate responsibility of the user, machine manufacturers often do not provide guards—one notable exception being the E.M.B. Co., Ltd.—and the average die caster has an alternative. Either he can design and make his own guards, which presents problems where the scale of operation is fairly small, or he can buy a guard from one of a few companies specializing in making such units. Some examples of proprietary guards will be described later. The designer of a die casting machine guard must take various factors into account if his work is to be successful. In particular, the guard must interfere as little as possible with the working cycle, so that the machine may be operated at the optimum speed.

Provision must also be made for projecting cores, which usually extend from the sides of the moving die member. In addition, the arrangement must be such that molten metal splashing from between the die faces cannot fall and solidify on the support rails or the control mechanism, and thus prevent the guard from moving into or out of position. Most guards take the form of sheet metal structures built up on weld-fabricated frameworks of angle- or channel-section steel and mounted on rollers which run on support bars attached to the fixed machine elements. They may be closed by hand or pneumatically, and are usually so arranged that only when they are fully closed can the normal machine cycles be initiated. With some of the more advanced guards, the completion of the closing movements automatically starts the machine cycles, as will be explained.

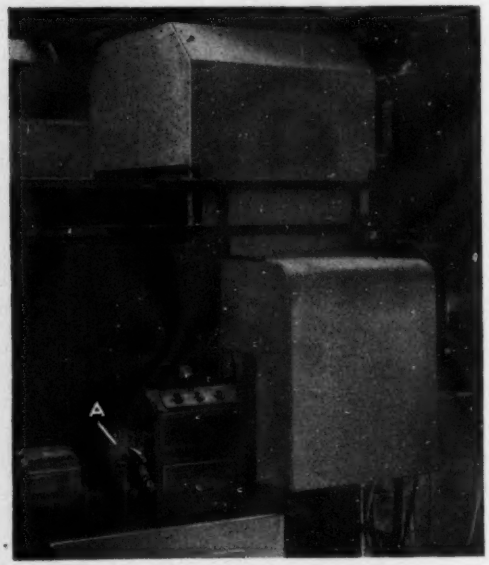


Fig. 1. This guard, fitted to a Herbert-Reed-Prentice 1½ Z machine installed at the works of Armstrong Patents Co., Ltd., is in three parts, and only the front portion is normally moved by the operator for extracting castings

SIMPLE HAND-OPERATED GUARDS

An example of a simple hand-operated guard, fitted to a Herbert-Reed-Prentice 1½ Z hot-chamber machine, at the Beverley, near Hull, works of Armstrong Patents Co., Ltd., is shown in Fig. 1. This guard is made in three parts of which those at the rear and the top are normally fixed in position and do not move during the machine cycle. The portion of the guard on the operator's side of the machine is mounted, by means of a bracket at each end, on two horizontal lengths of roller track of the type employed for sliding doors, and with this arrangement, the guard can be unsupported at the lower edge. Other parts of the machine have also been encased with fixed sheet metal covers, over which the guard passes as it is moved, and it is therefore difficult to place the hand into a dangerous position.

As mentioned in MACHINERY, 88/219—3/2/56, the Reed-Prentice machines employed by this company have been modified by transferring the operators' pedal control switches from the normal floor-level position to that indicated at *A*. Here, the switch is less likely to be inadvertently tripped by a clumsy foot movement of the operator or someone passing the machine. When the guard illustrated is opened, by moving it to the left, the separate push-buttons which control the individual stages of the cycle, also the foot switch *A* whereby the automatic cycle is initiated, are completely covered. Although the control switch *A* could be tripped without closing the guard completely, it is considered that an operator would be unlikely to do so, since it requires very little extra effort to close the guard after it has started moving.

Hydraulically-operated moving cores are widely used by his company, and, in several of the dies, such cores are provided in the fixed members. The guards employed must therefore be designed to clear the ends of the projecting cylinders, without leaving too much space which might allow trapping to occur. Another danger which this firm has noted is that associated with the return of sprues

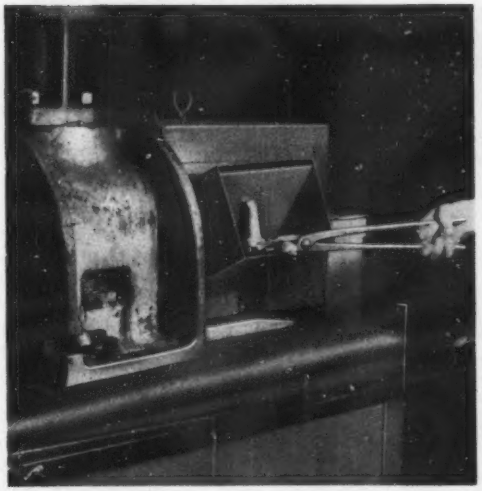


Fig. 2. An additional safeguard on the machine in Fig. 1 is the provision of shrouding for the metal pot. Ingot material and sprues for re-melting are inserted through a splash-proof door

or the insertion of fresh ingot material into the machine melting pots, which sometimes results in metal splash, particularly if the metal is allowed to fall into the pot or is damp. This danger has been overcome, and some incidental advantages gained, by shrouding the melting pots with sheet metal covers, as seen in Fig. 2.

On the side from which metal is normally placed in the pot a rectangular-section chute, large enough for the passage of the biggest pieces of scrap or ingot, is let into the cover at an angle of about 30 deg. to the horizontal. This chute is fitted with a door, hinged at the top so that it closes under gravity, and a stop is provided so that the door cannot jam shut. Metal to be fed into the pot is merely inserted through this door, as shown in Fig. 2, and allowed to slide down the chute, the door then closing to prevent the escape of any metal which may be splashed upwards.

POWER-OPERATED GUARDS

The first obvious development from the simple hand-operated cover for the dies, designed to intercept molten metal splash, is to provide for power opening and closing of the guard. Such an arrangement is particularly desirable for a large machine with a heavy guard, since it would be tiring for the operator to push it backwards and forwards at each machine cycle. An example of such a guard which was designed and installed by J. Broughton & Sons (Engineers), Ltd., 234 Pershore Road South, Birmingham, 30, is shown in Fig. 3, mounted on a No. 1 Lester-Phœnix cold-chamber machine. The guard structure is carried by grooved rollers near the top on two chamfered bars of rectangular section, secured at the right to the fixed platen and at the left to a fabricated structure clamped to the main machine members.

Between the inner and outer skins is mounted a long-stroke air cylinder, the ram of which extends through a hole in the end wall of the guard and is fixed to the structure at the left. The supply of air to this cylinder is controlled by means of a valve *B*, the spindle of which projects through an aperture in the outer skin. Air is delivered to

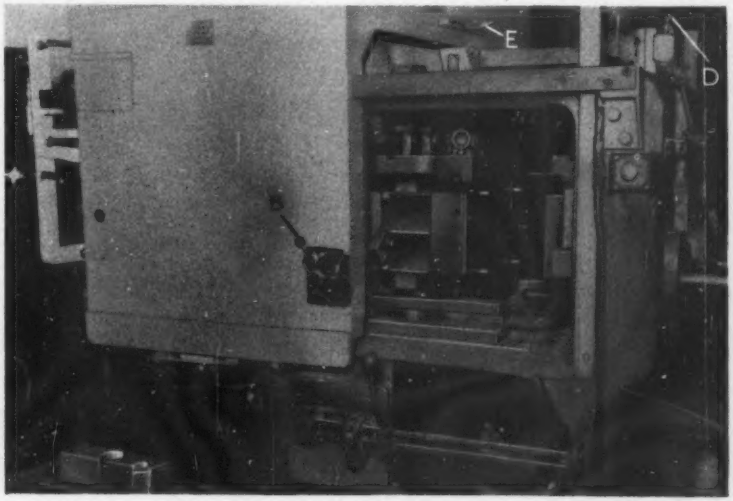


Fig. 3. A typical Broughton guard for a Lester-Phoenix No. 1 machine, arranged for powered movement by means of an air cylinder between the inner and outer skins, and controlled by the "directional" valve lever *B*

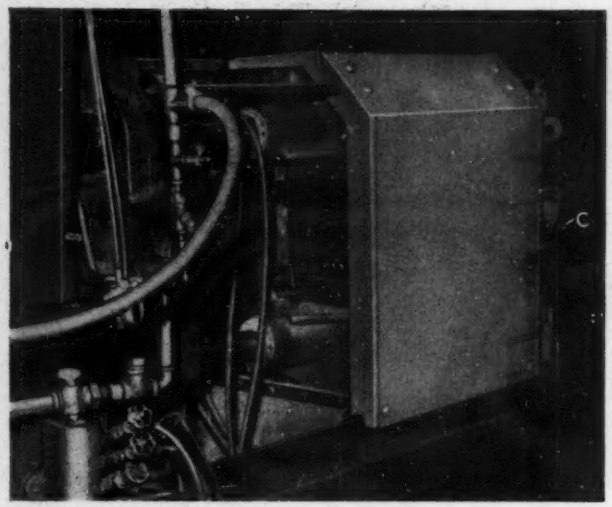


Fig. 4. Here a Broughton guard is seen fitted to a 21-in. Schultz machine of the older, inclined type. The operating valve C is located at the end remote from the die

this valve through flexible tubes, and the connections are so arranged that the movements of the valve lever to close and open the guard are directional.

It is important that there should be no danger of injury occurring should the operator's hand be trapped between the edge of the closing guard and the machine, and for this reason it is usual to fit a reducer valve and pressure gauge in the air circuit to the guard so that the pressure can be reduced to a lower value than that of the shop supply. Normally, pressures of the order of 25 to 30 lb. per sq. in. are employed, and the force exerted on the guard is then approximately 40 lb. with a 1½-in. bore air cylinder and a ½-in. diameter piston rod. When such a precaution is taken, however, the closing movement of the guard may occupy an appreciable time, particularly if it has to travel several feet.

With the air pressures quoted, it has been found that a period of as much as 2 sec. may be required for each guard movement, or an extra 4 sec. during each machine cycle, merely for closing and opening the guard. This period is constant whatever the duration of the machine cycle with a particular die, and if a die were designed for a speed of, say, 4 shots per min., there might be a loss of nearly one shot per min. In practice, however, the guard opening movement can usually be started at the same time as that of the dies, or after only a short delay, and the loss of time is then reduced by almost half. The fitting of an automatic reversing valve to the guard, as will be explained, permits a higher air pressure to be employed, with correspondingly faster travel, so that there is a further saving of time.

Another guard, of the same general form as that in Fig. 3, supplied by J. Broughton & Sons (Engineers), Ltd., is shown in Fig. 4, fitted to one of the older types of 21-in. Schultz hot-

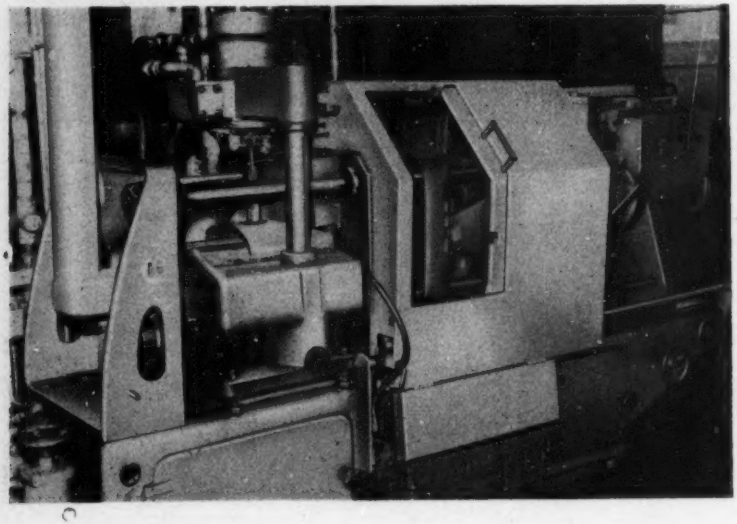


Fig. 5. This Broughton guard consists of a stationary hood with a door on the operator's side. The door is much lighter than the complete guard so that it can be closed and opened more quickly without fatigue

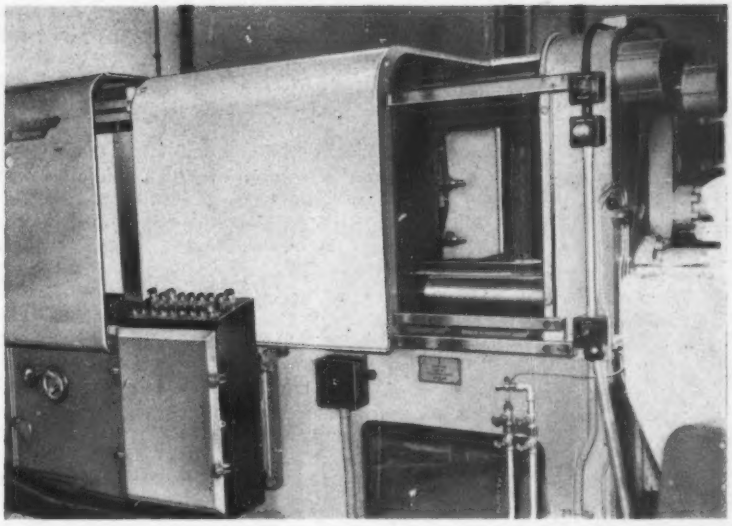


Fig. 6. A guard made by the Highwood Engineering Co., Ltd., for a Peco No. 10C cold-chamber machine. It is in two halves, and only the portion on the operator's side of the machine is normally moved

chamber machines, of inclined design. This guard is made in two halves, with a joint at the centre of the top portion in line with the direction of movement of the platen. The rear half of the guard can be moved by hand to the open position, when necessary, for die setting or adjustment, and a projection, fitted to the front half, engages the rear portion, to close both halves together. Normally, only the front half of the guard is retracted during the machine cycle, by means of the lever *C*, which controls the supply of air to the internal cylinder.

FURTHER EXAMPLES OF SIMPLE GUARDS

Another guard of simple design, made by J. Broughton & Sons (Engineers), Ltd., and fitted to an E.M.B. No. 12 machine, is seen in Fig. 5. This guard differs from the forms so far considered in that it has a fixed and comparatively rigid structure, clad with sheet metal panels. An aperture is provided in the sloping and vertical walls on the operator's side of the machine. Rails are mounted within the guard to support a sliding door, which closes the aperture and can easily be moved by hand, for unloading the castings, by reason of its light weight. The main guard is fitted with grooved rollers and supported on cylindrical bars, and it may easily be disconnected from the fixed machine members and retracted for die changing or adjustment, without the need for complete removal. A link bar at the further end of the door is connected to a valve which controls the flow of fluid in the die closing mechanism, so that when the door is opened

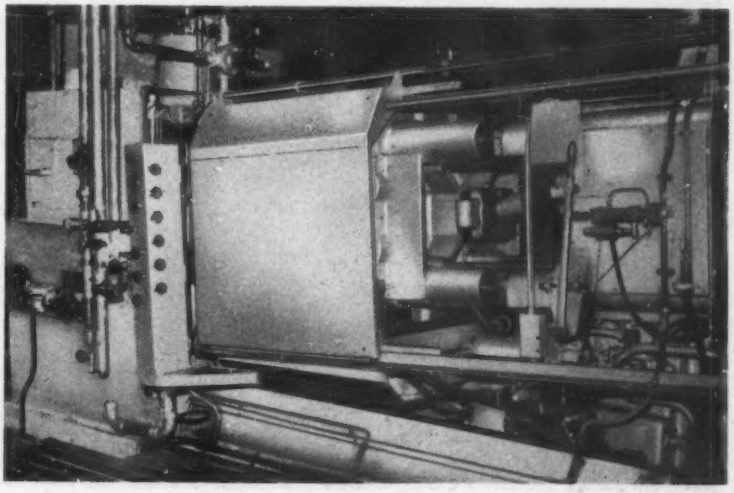


Fig. 7. Another Highwood guard, fitted to a 21-in. Schultz machine, and arranged for operation as part of the automatic cycle. The latest development of this guard is seen in Fig. 16 and 17

the dies cannot be closed. This method of interlocking is considered to offer important advantages, and will be discussed more fully later.

Fig. 6 shows a guard supplied by the Highwood Engineering Co., Ltd., 71-75 Allcock Street, Birmingham, 9, fitted to a Peco No. 10C machine. This guard, again, is constructed in two halves with a joint line parallel with the direction of platen movement, and normally only the portion on the operator's side of the machine is retracted for the removal of the castings. Operation of the guard, by means of a pneumatic cylinder, forms part of the automatic machine cycle, which is initiated by pressure on a push-button on the fixed platen.

The guard fitted to the older type of Schultz 21-in. machine illustrated in Fig. 7 was also supplied by the Highwood Engineering Co., Ltd., and works in conjunction with a pneumatic system which prevents die closure until the guard is in the advanced position. With the guard closed, the machine cycle proceeds automatically, and as the die members are opening, the guard is finally retracted. The latest form of this guard is discussed at the end of the article. Another guard, of similar type, made by the Wolverhampton Die Casting Co., Ltd., and fitted by them to one of the latest Schultz GJ electronically-controlled die casting machines installed in their new line production shop, is shown in Fig. 8. This guard runs on rollers with deep grooves, held in brackets at the lower edges, on thin rails formed by one edge of a length of angle-section steel at each side, and is actuated by an air cylinder which is mounted between the inner and outer skins.

INTERLOCKING OF GUARDS WITH MACHINE CYCLE

The next most obvious step, after an effective guard has been fitted to a die casting machine, with an automatic cycle, is to arrange for the cycle to be initiated by the guard as soon as it reaches the fully-closed position. Alternatively, on simpler machines and cold-chamber types on which hand-ladling is employed, the guard can be arranged to start the die closing movement automatically, as soon as it is fully closed. Probably the simplest method is to fit a limit switch to the fixed member of the machine and a projection on the guard, to operate the switch plunger. An example of such an arrangement is seen in Fig. 3, where the limit switch is indicated at *D* and the projection at *E*.

The use of a limit switch for this purpose, however, is not generally recommended, mainly because of the danger that it may stick in the closed position. There is also the possibility that an operator may interfere with the switch, because he finds that the guard is reducing his output rate. A preferable alternative is a magnetically-operated switch of the type seen in Fig. 9, fitted to the Schultz GJ machine in Fig. 8. Supplied by Ronald Trist & Co., Ltd., under the name Mobrey, this switch is totally enclosed in a die cast box in one side of which is an opening of inverted T-shape. Attached to the side of the guard is a magnet of suitable shape to enter the recess, and when the guard is shut and this magnet is engaged with the switch, the contacts are closed. Since the moving parts of the switch are totally enclosed they are likely to remain clean, and it would be difficult for an operator to interfere with

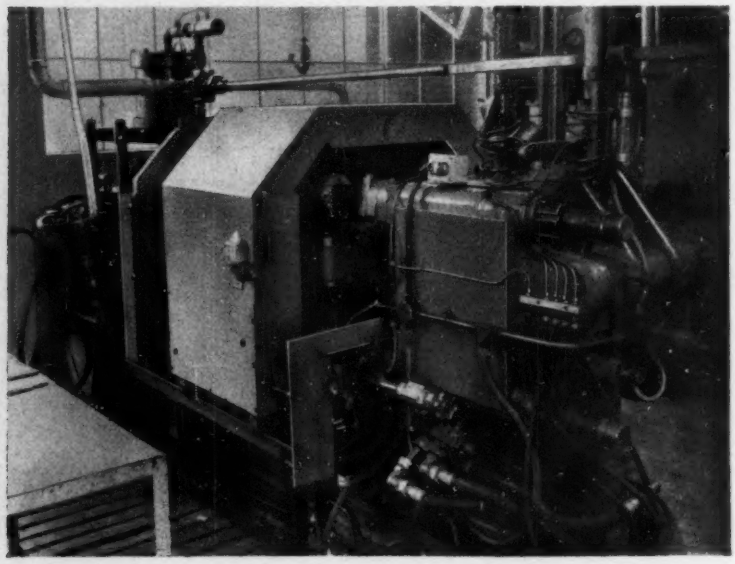


Fig. 8. A Schultz GJ electronically-controlled hot-chamber machine of the latest type, installed at the works of the Wolverhampton Die Casting Co., Ltd., is here seen fitted with a guard developed by that company

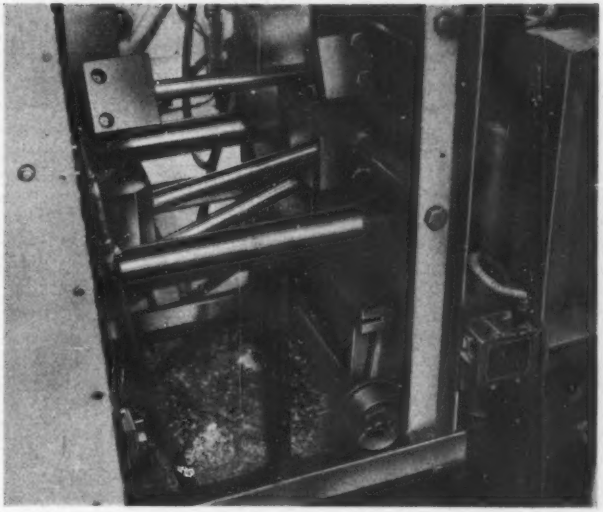


Fig. 9. Initiation of the automatic cycle of the machine in Fig. 8 is effected by a Mobrey magnetic switch. When the guard reaches the fully-closed position, a magnet on the guard enters an aperture in the switch casing

the actuating mechanism of the switch.

If there is no other accessible control for starting the machine cycle available to the operator, he must close the guard before each casting operation can begin, and an effective means of ensuring that this procedure is followed is to arrange for the cycle to be started by the completion of the closing movement. As an alternative or additional safeguard, it may be preferred to arrange the guard so that it operates a switch when it is in the advanced position, to complete a circuit to another control whereby the remainder of the machine cycle is governed. Such a system is employed on the Herbert-Reed-Prentice 1½G. cold-chamber machine in Fig. 10, which is installed at the works of J. W. Singer & Sons, Ltd., Frome. Here, because of the absence of the vertical hot-chamber injection mechanism, it is convenient to arrange for the guard to move in the opposite direction to those on the machine in the previous illustrations.

The guard in Fig. 10 moves on cylindrical rails on which it is supported by grooved rollers held in brackets outside the structure, and can easily be lifted off when necessary. Hand operation is satisfactory because of the lightness of the design. On the side shown, which is at the rear of the machine, the roller brackets are connected by a steel strip with drilled holes for the attachment of a cam *F*. When the guard is moved to the right, into the closed position, this cam depresses the plunger of a switch attached to the side of the machine, with the result that the remainder of the machine circuit is energized. It will be noted that the ends of this guard—and of the others so far

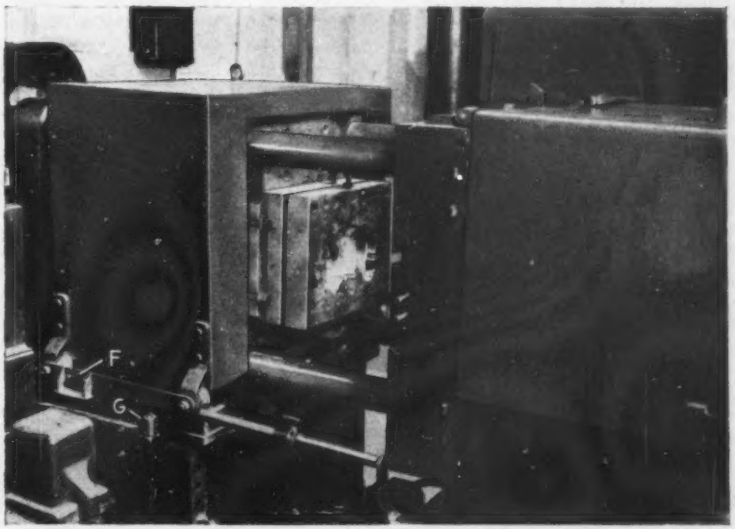


Fig. 10. A Herbert-Reed-Prentice 1½G cold-chamber machine, fitted with a guard designed by J. W. Singer & Sons, Ltd., and installed in their works. The guard is moved by hand in the opposite direction to that normally adopted

shown—are a fairly close fit round the platens or other machine elements which they embrace.

Where the action of closing the guard starts the machine cycle, it is ensured that the guard must be closed each time the machine is operated, but such an arrangement does not provide a complete safeguard. On some machines, the cycle is controlled in such a manner that a sliding guard can conveniently be interlocked so that the dies cannot be closed until the guard is in the advanced position. An example is afforded by the range of machines made by the E.M.B. Co., Ltd., West Bromwich, which was reviewed in MACHINERY, 85/455—27/8/54. These machines are made in four sizes, of which the No. 14 is seen in Fig. 11, and are supplied with guards of the inverted U-shape shown. This guard is made in one piece and is fitted with grooved rollers which run on cylindrical guide rails attached to the fixed machine members.

The guard is closed pneumatically by means of the control lever for the automatic cycle of the machine, and is mechanically interlocked with the controls for closing the die and operating the injection plunger. Thus, the machine cycle cannot be initiated until the guard is in the fully-closed position, although the machine can be operated continuously, with the guard closed, when a die fitted with arrangements for automatic unloading is in use. The die can be observed through a toughened glass window in the side of the guard, which can be obscured by a sliding metal door. An inner skin serves to protect the guide rails and rollers from flash which might solidify and prevent the guard from opening or closing freely.

Many machines do not lend themselves so readily to the interlocking of the operation of the guard with the main controls. On such machines, the dies may be closed either by a pneumatic or hydraulic cylinder, which may be directly controlled by the operator's lever, or through a pilot valve or solenoid valve and push-button. In certain circumstances, failure of such a system may result in the platen moving forward again as soon as it has reached the fully open position, or before. If the operator has reached forward to remove the spray of castings or apply lubricant as soon as the die has opened, as is usual, he may be trapped between the platens.

To provide the maximum protection against the platens closing accidentally with the guard still open, some form of positive mechanical restraint may be applied, as will be discussed later. On many machines, the provision of such restraint is difficult and it may not be completely effective. It is therefore recommended that every machine should be fitted with a mechanically-operated exhaust valve at the pressure side of the platen-closing cylinder. Ideally, this valve should be connected directly to the guard by a linkage, so that it is held in the open position except when the guard is fully closed. With such an arrangement, failure of a limit switch or other electrical component, or of an air or hydraulic valve, could not cause the dies to close accidentally with the guard open, since any fluid which entered the cylinder would be immediately diverted to the supply tank.

A valve employed for this purpose should be of such a size that the pressure in the cylinder is immediately relieved when it is opened, and it should pass the full output of the pump, or other fluid supply, without allowing sufficient pressure to build up in the cylinder to move the platen. Where such a valve is used, it is, of course, necessary to fit some form of retainer or locking unit to

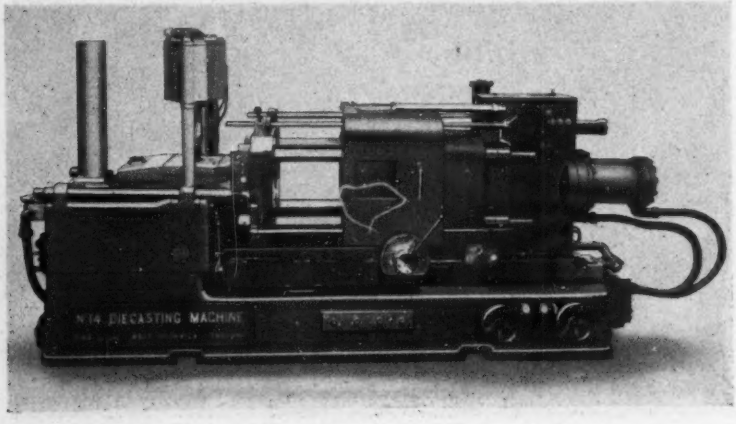


Fig. 11. The current range of machines of both hot- and cold-chamber design, made by the E.M.B. Co., Ltd., comprises four sizes, of which the No. 14 is here shown, each fitted with a guard interlocked with the machine cycle

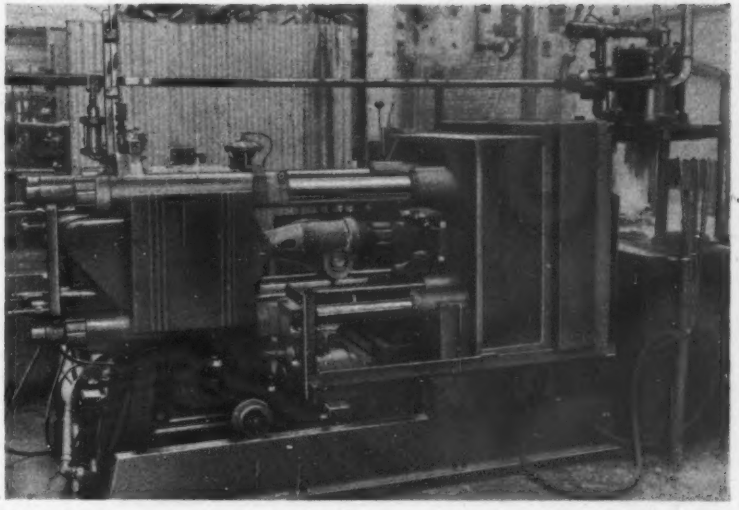


Fig. 12. Another Schultz GJ machine at the Wolverhampton Die Casting Company's works is fitted with this experimental fixed guard, which has a hinged gate at the far side for casting removal

hold the guard in the closed position until the dies are again opened. If this precaution were not observed, opening of the guard before the metal had solidified might result in the dies parting and metal spraying out. Where the platen of a machine is moved by an air cylinder, it may be expedient to fit a valve in the supply line, to be operated at the same time as the exhaust valve, to prevent platen creep when the latter valve is open.

The use of such an exhaust valve on the direct-hydraulic machines, for example the older types of H.P.M. and the Triulzi, might not stop the platen from moving under certain conditions. However, the fitting of such a valve to this type of machine considerably eases the problem of providing positive mechanical restraint, which would not be required to withstand the high pressures applied in closing the platens. Such machines should always be provided with a guard which covers the die parting line since unnoticed accumulations of dirt or flash on the die faces may cause them to be held apart locally even with the full pressure applied. Thus, interlocking of the injection control to prevent injection until the die is under pressure may not be fully effective against the escape of molten metal.

Modern semi-automatic and automatic die casting machines are normally equipped with control units which ensure that injection cannot take place until a signal is received that the dies are fully locked. It may be an advantage on older or simpler machines to fit a pressure exhaust valve, of the type discussed above, to the injection cylinder, so that injection is positively prevented except when the guard is closed. Thus, even if the switch or other unit providing the "dies shut" signal were to stick, injection would still be prevented unless the guard was in the safe position.

SAFEGUARDS AGAINST TRAPPING BETWEEN DIE MEMBERS OR PLATENS

Any guarding system to be applied to a pressure die casting machine must obviously be designed to safeguard the operator against both burns and trapping. As mentioned above, it is considered that the only certain method of preventing the platens from coming together accidentally is to interpose a positive mechanical stop between them as soon as they have opened, and various methods of achieving this result are being investigated. Probably the simplest solution is to introduce a length of steel bar between the platens automatically, as soon as they are fully open, and an example of such a stop, fitted to a Schultz GJ hot-chamber machine in the works of the Wolverhampton Die Casting Co., Ltd., is seen in Fig. 12.

This machine is provided with a guard which comprises a weld-fabricated framework of angle-section steel, covered with sheet metal and expanded metal panels, and has a sliding transparent window at the top so that the die can be observed. A steel framework attached to the fixed machine members supports the guard, which is normally secured in the position shown, but can easily be unfastened and pushed back clear of the platens to permit of die changing or adjustment. At the operator's side of the machine, shown in Fig. 13, the guard has a gate *H*, which can be opened on a vertical hinge when a spray of castings is to be removed from the die. Within the guard, a bracket, secured to the face of the fixed platen, provides a mounting for a short length of angle-



Fig. 13. View, from the operator's side, of the machine in Fig. 12, showing details of the hinged gate which is arranged so that it lowers a mechanical stop *J* into position between the platens when it is opened

section steel *J*, which acts as the stop to prevent the die from closing while the gate is still open.

Welded to the top of the stop is a short length of bar *K*, which projects at an angle, and there is another similar bar *L* on the inside of the gate. As the gate is closed, the bar *L* comes into contact with the bar *K*, and the bars are so arranged that the stop *J* is lifted to a height at which the tie bar boss of the moving platen can pass beneath it. The closing platen can then lift the stop a little further, if necessary, as the dies come together during the automatic cycle of the machine. Although this arrangement provides a definite restraint when the stop *J* is in position, it is realized that it only represents a first step, and that the arrangement will have to be made more positive before it can be widely adopted. It is suggested that the gate and the stop might be connected, so that the stop would not depend on gravity but would be pulled down into position.

Another mechanical stop, fitted by the above-named company to their large Precision machines, is shown in Fig. 14. This stop takes the form of a length of H-section steel *M*, reinforced by welding strips of steel to the openings, which is attached by two links to brackets on the lower tie bar at the rear of the machine. The bar is normally only placed between the platens when adjustments are to be made to the dies, or when die changing is in progress, but it would be comparatively simple to arrange for it to be advanced as soon as the dies were opened, either by an air cylinder or by some form of linkage. It may be noted that the die in use on the machine in Fig. 14 has a large projection at one side to carry cam pins for the operation of a horizontally-moving core. Where such mechanisms as core slides or actuating cylinders project beyond the platens, it is necessary, as previously pointed out, to employ a guard which will clear the largest obstruction likely to be encountered on the particular machine.

One method of providing for variations in the size and disposition of such projections is to make the guard in two or more parts, as in Fig. 1, and to arrange for the parts at the top and rear of the die to remain fixed

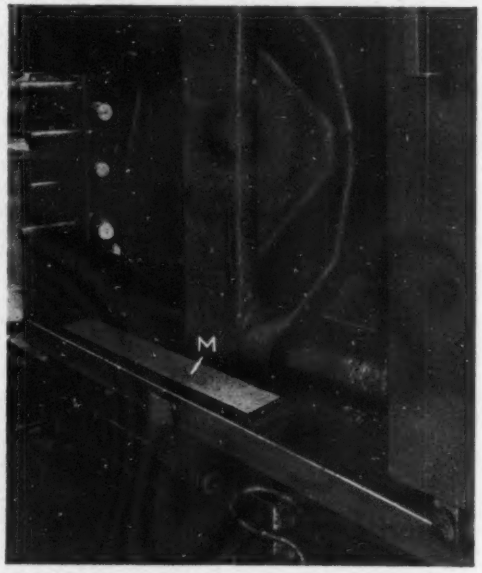


Fig. 14. The large Precision machines at the works of the Wolverhampton Die Casting Company, Ltd., are fitted with heavy stops, as at *M*, hinged to the lower tie bars, which can be moved into position between the platens when they are open

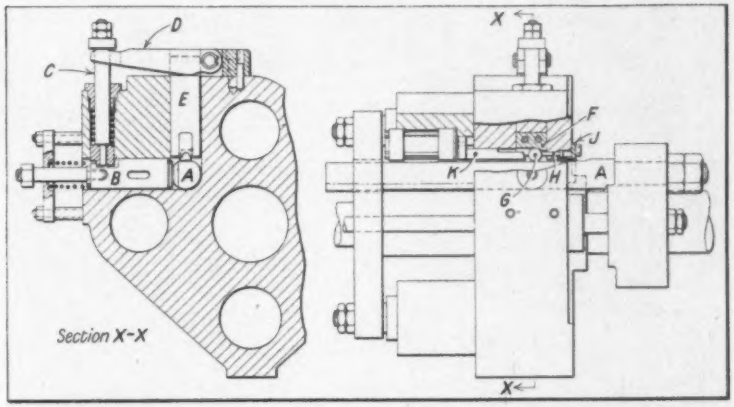


Fig. 15. Views of the mechanism fitted to certain machines operated by the Birmingham Aluminium Casting (1903) Co., Ltd. The moving platen can be stopped in any position

during the operation of the machine. Where there are projections from the die on the operator's side, it may be possible to fit removable sections into the supporting framework of the guard so that the latter can effectively cover the parting plane. Care must be taken to ensure that no new risks, for example of trapping between the edge of the guard and the projection, are introduced when such a guard is power operated. One method which has proved effective is to edge the guard with foamed rubber strip, so that even if a hand is caught, no serious injury is caused.

The fitting of such positive stops as those described above to machines of the direct-hydraulic type is more difficult, because of the high forces which may be exerted on the moving platens throughout their ranges of travel. On the larger machines, these forces would necessitate very substantial stop bars which would be heavy and difficult to move into place. However, if such a machine were fitted with a pressure exhaust valve, mechanically connected to the guard, a very much lighter mechanical stop would suffice to prevent creep of the moving platen.

AUTOMATIC POSITIVE STOP MECHANISM

Although the stop mechanisms described above are useful when the platens retract fully, they do not provide protection if a platen only partially opens before reversing to close the die, as may happen should a valve fail during the opening movement. Die casting machines built by the Birmingham Aluminium Casting (1903) Co., Ltd., for their own use, incorporate a platen stop mechanism which will arrest the movement of a platen at any point in the stroke. This mechanism is shown in Fig. 15, and it may be noted that the machine in question is of the conventional toggle-lock design and has a single hydraulic platen-closing cylinder. The pressure exerted by this cylinder is continuously resisted by two small platen-return cylinders so that when pressure at the rear of the large cylinder is released the dies are automatically opened.

The platen-stop mechanism incorporates a locking rack *A*, with a flat vertical surface on one side, in which ratchet teeth are cut. This rack is attached at one end to the moving cross-head which carries the toggle links and is moved longitudinally as the dies are opened and closed. At the rear end, the rack passes through a bore in the fixed platen of the machine, as seen in the section *X-X*. In another bore in this platen, at 90 deg. to that housing the rack, there is an arrester bar *B*, and on the end surface of this bar there are four teeth, of similar shape to those on the rack but facing in the opposite direction. The arrester bar has a machined flat on its upper surface, near the outer end, and is subjected to the pressure of a compression spring which tends to urge it inwards towards the rack. Normally, the bar is prevented from engaging the rack by means of a stop pin *C*, in a vertical bore above the bar *B*, the end of the pin being held down between the cheeks of the flat portion by another compression spring.

The upper end of the pin *C* is engaged by the forked end of a lever *D*, and is fitted with a washer and locking nuts, so that upward pressure can be exerted by this lever. At the other end, the lever *D* is pivoted on a bracket mounted on top of the fixed platen, and it has a thickened portion near that end. Within this thickened portion is machined a rectangular aperture, to accommodate the upper end of an actuating plunger *E*, which is held in a bore directly above the rack *A*. In the lower end of the plunger *E*, there is a slot, in which is pinned a cam *F*, seen more clearly in the right-hand view, and beneath this cam, in the lower end of the slot, resting on another flat surface machined on top of the rack *A*, is a roller *G*. Level with

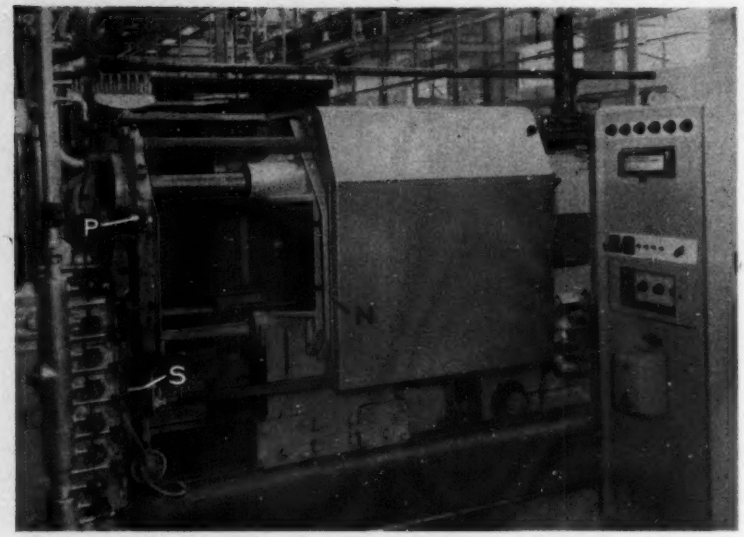


Fig. 16. General view of a Schultz type GJ electronically-controlled machine fitted with the fully automatic guarding system developed by the Highwood Engineering Co., Ltd., in conjunction with a leading die casting company

the centre of the roller, at the right, is a spring-loaded pin *H*, which serves to return the roller to the position shown after the mechanism has operated, and a scraper blade *J* is provided to keep the flat surface on top of the rack clean.

Outside the fixed platen, at the left, is mounted a small-diameter air cylinder, and the ram of this cylinder is fitted with a plunger *K*, which operates in a bore above that for the rack *A*. The cylinder is connected to a valve on the pedestal from which the movements of the die casting machine are controlled, and the arrangement is such that the valve must be held up, against the pressure of a return spring, at the same time that the "close-platens" push-button is depressed, two hands being required to operate the machine. If this valve is not held up, or is released while the platen is moving, air will be supplied to the rear end of the cylinder so that the ram is moved towards the right. This movement results in the plunger *K* pushing the roller *G* to the right, to lift the actuating plunger *E* and the lever *D*, which pulls the pin *C* upwards. The arrester bar *B* is thus released, and it moves inwards, under the pressure of its spring, until its teeth engage with those of the rack, which is thus arrested and prevents further movement of the toggle-link cross-head towards the closed position.

The machine controls are so arranged that should pressure oil be supplied to the platen-closing cylinder without the valve lever being held up by the operator, the arrester mechanism will be actuated. After the mechanism has functioned, it can be readily re-set by means of a forked lever which is introduced into the gap between the nut on the end of the arrester bar *B* and the spring pressure plate, this lever being in the charge of the supervisor. Since an operator might be tempted to fix the lever of the valve in the upward position, a limit switch is fitted above it so that a circuit is completed when the lever is raised. This circuit includes a thermal overload switch with a delay of 15 sec., and should the lever be held up for a longer period the overload switch cuts off the current to the machine so that it cannot be operated. The supervisor must then unlock the control box to re-set the overload switch before production can proceed.

FULLY-AUTOMATIC GUARDING SYSTEM

Development work carried out by a well-known die casting company and the Highwood Engineering Co., Ltd., has resulted in the production of a fully-automatic guarding system which can be applied to most of the currently available machines. In Fig. 16, this equipment is seen applied to a Schultz GJ electronically controlled machine, and it is of interest to note that provision can be made for the machine to be operated from the normal side, or from the opposite side if necessary. From the illustration, it will be observed that the guard is made in two parts, of which the moving portion, on the operator's side, comprises a vertical side and part of the horizontal top of the assembly. The large panel on the operator's side is of glass fibre reinforced plastics sheet to reduce the weight of the moving portion of the guard and permit faster operation.

The two portions of the guard are supported on cylindrical bars which are carried in brackets on the fixed platen at the furnace end, and on outriggers fixed to the tie bar extremities at the other

end of the machine. At the lower edge, the guard is guided by a square-section rail, mounted in the same manner as the main cylindrical bar, rollers being provided in the guard with their axes vertical so that they engage the sides of the bar. At the left-hand end of this rail, on the operator's side of the machine, there is a cylindrical portion, and when the rail is turned through about 45 deg., by an air cylinder at the right-hand end, the shoulder adjacent to the cylindrical portion prevents the guard from being retracted.

A view of the machine from the rear showing the mechanism for guard operation and interlocking is given in Fig. 17. Here, the air cylinder which turns the rail is indicated at *L*, and the end of the guard-moving cylinder at *M*. The cylinder is supplied with air at the normal shop pressure of 80 lb. per sq. in., and to prevent injury to the operator from trapping by the guard, the latter is fitted with a reversal valve which is accommodated between the outer and inner skin panels. Fitted to the leading vertical edge of the guard is a hinged bar, indicated at *N*, in Fig. 16, and when this bar is pushed towards the guard edge by contact with an operator's body or arm, the valve is depressed and the guard returns to the open position, where it remains until the cycle-start button *P* is again depressed.

Because of the rapid movement of the guard for both closing and opening, it was found that considerable vibration was caused when it reached the end of its travel, and with previous designs the life was short. This drawback has been overcome by fitting a tubular motor car type shock absorber *R*, Fig. 17, which is linked to the guard through a bell-crank lever and is brought into operation only at the extreme ends of the travel, by means of adjustable stops. Motor car type shock absorbers were chosen for their reliability and low initial cost and have been found to be very satisfactory for this purpose. On reaching the closed position, the front edge of the guard depresses the plunger of a small air valve S, Fig. 16, which controls the direction of the air supply to the cylinder *L*, Fig. 17, with the result that the rail is turned to lock the guard in the closed position.

On the Schultz machine, which was fully described in MACHINERY, 90/1232-31/5/57, the closing of the dies is controlled by means of a large-capacity hydraulic valve, actuated by an air cylinder. In Fig. 17 this valve is seen at *T*, and the air cylinder is mounted on the further end in a position co-axial with the valve plunger. The free end of this plunger is normally protected by a cover, and for the adaptation shown, this cover has been removed and a box-shaped structure added at that end. Fitted to the square-section rail is a fouling bracket *U*, which in the position shown, is set between the end wall of the box-shaped structure and the valve plunger, when the guard is in the unlocked condition. When the rail is turned by its air cylinder, the bracket *U* is lifted clear of the valve plunger, and as the rail reaches the guard-locked position, one of two air valves *W*, on an outrigger, is actuated. Air is then supplied to the cylinder controlling the hydraulic valve *T*, which is thus opened so that the dies close.

The remainder of the automatic cycle then follows, and after the timer-controlled chilling period for the injected metal has expired, the air supply to the cylinder controlling the main valve is reversed. When the die has opened, another valve is operated to reverse the direction of the air supply to the cylinder *L*, Fig. 17, and the rail is returned to the unlocked position. The bracket *U* is interposed between the die-operating valve plunger and the box-shaped structure wall, to prevent operation of the valve, and the second of the two pilot valves *W* is operated. This valve controls the air supply to the guard cylinder, and its opera-

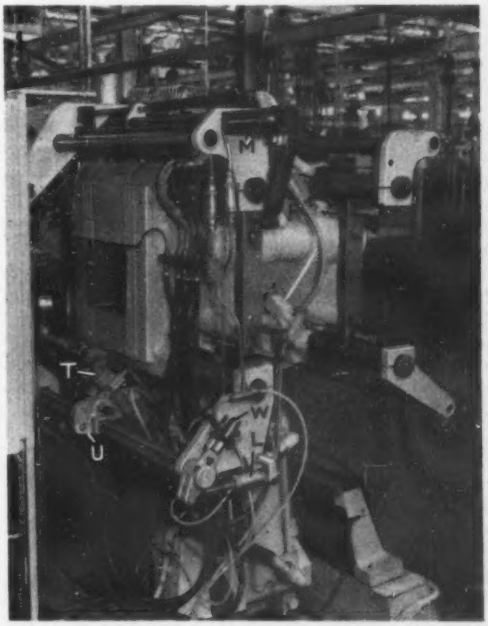


Fig. 17. Details of the mechanism for the operation of the guard shown in Fig. 16 may be seen in this view from the rear of the machine. A motor car type shock absorber *R* is fitted, to provide for rapid deceleration of the guard at the end of its movement

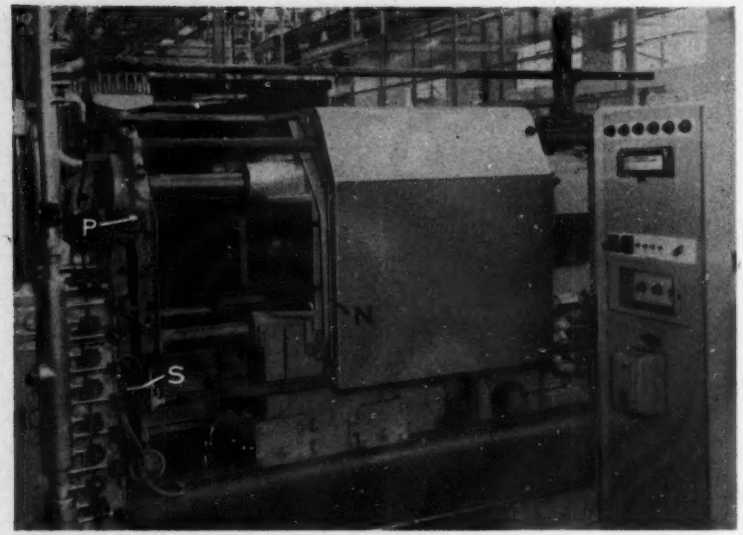


Fig. 16. General view of a Schultz type GJ electronically-controlled machine fitted with the fully automatic guarding system developed by the Highwood Engineering Co., Ltd., in conjunction with a leading die casting company

the centre of the roller, at the right, is a spring-loaded pin *H*, which serves to return the roller to the position shown after the mechanism has operated, and a scraper blade *J* is provided to keep the flat surface on top of the rack clean.

Outside the fixed platen, at the left, is mounted a small-diameter air cylinder, and the ram of this cylinder is fitted with a plunger *K*, which operates in a bore above that for the rack *A*. The cylinder is connected to a valve on the pedestal from which the movements of the die casting machine are controlled, and the arrangement is such that the valve must be held up, against the pressure of a return spring, at the same time that the "close-platens" push-button is depressed, two hands being required to operate the machine. If this valve is not held up, or is released while the platen is moving, air will be supplied to the rear end of the cylinder so that the ram is moved towards the right. This movement results in the plunger *K* pushing the roller *G* to the right, to lift the actuating plunger *E* and the lever *D*, which pulls the pin *C* upwards. The arrester bar *B* is thus released, and it moves inwards, under the pressure of its spring, until its teeth engage with those of the rack, which is thus arrested and prevents further movement of the toggle-link cross-head towards the closed position.

The machine controls are so arranged that should pressure oil be supplied to the platen-closing cylinder without the valve lever being held up by the operator, the arrester mechanism will be actuated. After the mechanism has functioned, it can be readily re-set by means of a forked lever which is introduced into the gap between the nut on the end of the arrester bar *B* and the spring pressure plate, this lever being in the charge of the supervisor. Since an operator might be tempted to fix the lever of the valve in the upward position, a limit switch is fitted above it so that a circuit is completed when the lever is raised. This circuit includes a thermal overload switch with a delay of 15 sec., and should the lever be held up for a longer period the overload switch cuts off the current to the machine so that it cannot be operated. The supervisor must then unlock the control box to re-set the overload switch before production can proceed.

FULLY-AUTOMATIC GUARDING SYSTEM

Development work carried out by a well-known die casting company and the Highwood Engineering Co., Ltd., has resulted in the production of a fully-automatic guarding system which can be applied to most of the currently available machines. In Fig. 16, this equipment is seen applied to a Schultz GJ electronically controlled machine, and it is of interest to note that provision can be made for the machine to be operated from the normal side, or from the opposite side if necessary. From the illustration, it will be observed that the guard is made in two parts, of which the moving portion, on the operator's side, comprises a vertical side and part of the horizontal top of the assembly. The large panel on the operator's side is of glass fibre reinforced plastics sheet to reduce the weight of the moving portion of the guard and permit faster operation.

The two portions of the guard are supported on cylindrical bars which are carried in brackets on the fixed platen at the furnace end, and on outriggers fixed to the tie bar extremities at the other

end of the machine. At the lower edge, the guard is guided by a square-section rail, mounted in the same manner as the main cylindrical bar, rollers being provided in the guard with their axes vertical so that they engage the sides of the bar. At the left-hand end of this rail, on the operator's side of the machine, there is a cylindrical portion, and when the rail is turned through about 45 deg., by an air cylinder at the right-hand end, the shoulder adjacent to the cylindrical portion prevents the guard from being retracted.

A view of the machine from the rear showing the mechanism for guard operation and interlocking is given in Fig. 17. Here, the air cylinder which turns the rail is indicated at *L*, and the end of the guard-moving cylinder at *M*. The cylinder is supplied with air at the normal shop pressure of 80 lb. per sq. in., and to prevent injury to the operator from trapping by the guard, the latter is fitted with a reversal valve which is accommodated between the outer and inner skin panels. Fitted to the leading vertical edge of the guard is a hinged bar, indicated at *N*, in Fig. 16, and when this bar is pushed towards the guard edge by contact with an operator's body or arm, the valve is depressed and the guard returns to the open position, where it remains until the cycle-start button *P* is again depressed.

Because of the rapid movement of the guard for both closing and opening, it was found that considerable vibration was caused when it reached the end of its travel, and with previous designs the life was short. This drawback has been overcome by fitting a tubular motor car type shock absorber *R*, Fig. 17, which is linked to the guard through a bell-crank lever and is brought into operation only at the extreme ends of the travel, by means of adjustable stops. Motor car type shock absorbers were chosen for their reliability and low initial cost and have been found to be very satisfactory for this purpose. On reaching the closed position, the front edge of the guard depresses the plunger of a small air valve S, Fig. 16, which controls the direction of the air supply to the cylinder *L*, Fig. 17, with the result that the rail is turned to lock the guard in the closed position.

On the Schultz machine, which was fully described in MACHINERY, 90/1232-31/5/57, the closing of the dies is controlled by means of a large-capacity hydraulic valve, actuated by an air cylinder. In Fig. 17 this valve is seen at *T*, and the air cylinder is mounted on the further end in a position co-axial with the valve plunger. The free end of this plunger is normally protected by a cover, and for the adaptation shown, this cover has been removed and a box-shaped structure added at that end. Fitted to the square-section rail is a fouling bracket *U*, which in the position shown, is set between the end wall of the box-shaped structure and the valve plunger, when the guard is in the unlocked condition. When the rail is turned by its air cylinder, the bracket *U* is lifted clear of the valve plunger, and as the rail reaches the guard-locked position, one of two air valves *W*, on an outrigger, is actuated. Air is then supplied to the cylinder controlling the hydraulic valve *T*, which is thus opened so that the dies close.

The remainder of the automatic cycle then follows, and after the timer-controlled chilling period for the injected metal has expired, the air supply to the cylinder controlling the main valve is reversed. When the die has opened, another valve is operated to reverse the direction of the air supply to the cylinder *L*, Fig. 17, and the rail is returned to the unlocked position. The bracket *U* is interposed between the die-operating valve plunger and the box-shaped structure wall, to prevent operation of the valve, and the second of the two pilot valves *W* is operated. This valve controls the air supply to the guard cylinder, and its opera-

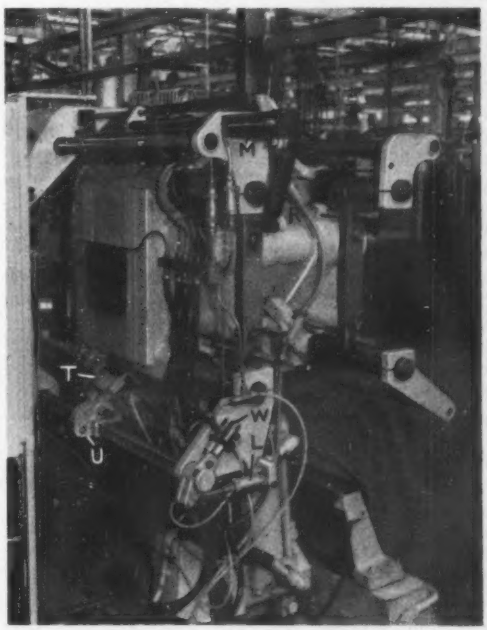


Fig. 17. Details of the mechanism for the operation of the guard shown in Fig. 16 may be seen in this view from the rear of the machine. A motor car type shock absorber *R* is fitted, to provide for rapid deceleration of the guard at the end of its movement



Fig. 18. The guard developed by the Rushton Organisation, Ltd., here seen fitted to a No. 12 E.M.B., hot-chamber machine, has detachable panels and is fully interlocked with the machine cycle

tion results in the full-speed retraction of the guard to permit removal of the castings. With this system, it has been found that the machine cycle is extended by only a fraction of a second and a high degree of safety is achieved.

Another important system of machine control, which incorporates an efficient guarding system, is supplied by the Rushton Organisation, Ltd., 173 Clarence Gate Gardens, London, N.W.1. This system, which will be fully described in a later article, is designed to enable a die casting machine to be operated at the optimum speed as determined by the die temperature, and includes an arrangement whereby the dies are held in the open position should the pre-set temperature be exceeded through too-rapid cycling. The same mechanism also serves to prevent the dies from being closed before the sliding guard is in the safe position. A general view of the Rushton equipment, as fitted to a No. 12 E.M.B. machine at the works of Archibald Kenrick & Sons, Ltd., West Bromwich, is given in Fig. 18, and it will be seen that the front and rear edges of the guard are capped with rubber strip, to avoid bruising should the operator be trapped.

Rubber flaps are also fitted to the guard edges to provide more efficient protection against metal splash. The guard is built up from metal panels on a framework of angle-section steel and each panel is detachable. Limit switches are fitted to the frame in positions such that they are operated by the panels, which are held in place by quick-release fasteners, and the removal of any panel renders the guard, and the machine, inoperative, except that the platen can be inched along for die setting purposes. The guard is supported on rollers on narrow rails at each side, and is traversed by a short-stroke air cylinder *X*, through levers which give the required length of stroke.

NEW INDUSTRIAL DETERGENT—Suitable for the removal of oil, grease, and dirt from all types of surfaces, a new industrial detergent known as Dertolit has been developed by Exsud Engineering, Ltd., Home Industrial Division, 26/27 Cowcross Street, London, E.C.1. It may be employed for removing grease and oil from concrete and cement floors; glass; wood; paintwork; machinery and tools; rubber and plastics; also trucks and cars. Dertolit is a clear liquid, which is odourless, non-inflammable, non-abrasive, and neutral. It is highly concentrated, and one to two tablespoonsful can be diluted with from 10 to 20 quarts of water.

NEW FLATTED WIRE FOR PACKAGING.—A new type of packaging wire which is nominally circular in cross-section but has two parallel flats has been developed by The Package Sealing Co., Ltd., Ealing, London, W.5, and is claimed to combine the advantages obtainable from the normal round wire and flat strip materials. Available in three widths, the wire is produced with a rust-proof galvanized finish, and, it is stated, conforms smoothly to the edges of cartons, for example, without causing damage. The company has also introduced an improved design of Pakseal wiring machine, for securing the wire to the cartons.

Churchill Fully-automatic Production Line For Layshaft Cluster Gears



Fig. 1. View of the Rigidhobber section of the Churchill fully-automatic gear production line, looking towards the starting end

Brief details were given in MACHINERY, 93/966—22/9/58, of a 175-ft. long, fully-automatic machine line which Churchill Gear Machines, Ltd., Blaydon, Co. Durham, have built for the British Motor Corporation, for producing gearbox layshaft cluster gears. Claimed to be the most advanced production line of its type yet constructed in Europe, it incorporates all the features now recognized as being essential in transfer lines for maintaining high production efficiency. Loading and unloading machanisms and conveyors are of standardized designs, and the machines are arranged for independent operation, with provision for parts storage for each. Inspection on a 100 per cent basis is performed after each stage of gear-cutting. The control gear fitted conforms to the J.I.C. standards established in the U.S.A., to ensure maximum operating efficiency, and easy replacement of the units when servicing is carried out.

The layshaft cluster in question has three helical gears of 28, 24 and 18 teeth by 13·05 D.P., and a spur gear with 13 teeth of 10 D.P., and the operations performed comprise hobbing, gear shaping, tooth rounding, tooth chamfering, shaving, and plunge grinding. Although six different types of machines are involved, together with washing, brushing, and gauging stations, making a total of 26 units in the line, only two types of loading units, and two types of connecting conveyors are employed.

Fig. 1 is a view of the line from a point close

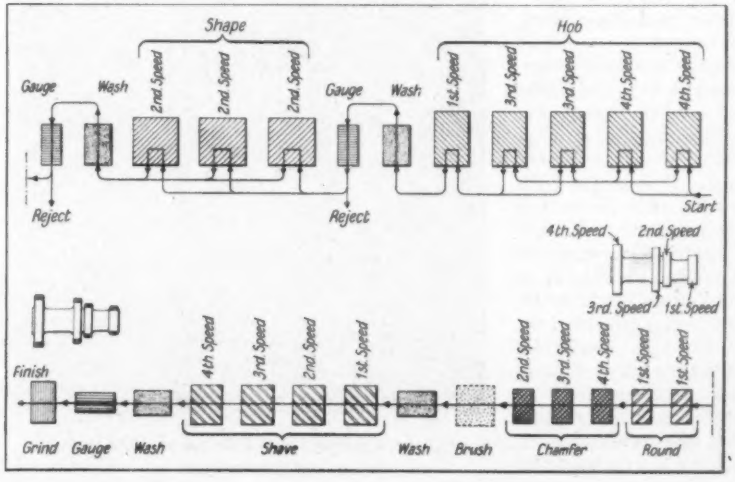


Fig. 2. Diagrammatic layout of the Churchill fully-automatic line for producing layshaft cluster gears

M

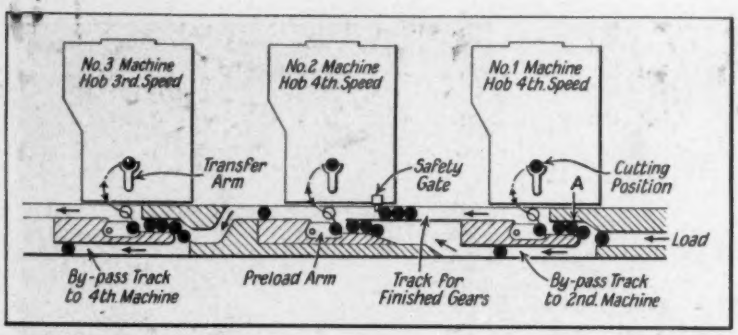


Fig. 3. Diagram showing the arrangement for feeding work to the hobbing machines

to the last of the five gear hobbing machines, looking back towards the starting end, and the layout is shown diagrammatically in Fig. 2. The Churchill Mark IV Rigidhobbers are the first of an improved type, with new electrical control gear and automatic lubrication throughout. The cycle time for the whole installation is 1·2 min., and to achieve the production required, two of the five hobbing machines cut the fourth-speed gear, two machines hob the third-speed gear, and the remaining machine hobs the first-speed gear.

Layshaft gear blanks, turned from En. 34 steel forgings, are rough bored only, and location for all the machining and gauging operations is taken from chamfers provided at the ends of the bore. The workpieces are loaded by hand on to the centre of a slat-type conveyor extending across the front of the hobbing machines as seen in Fig. 1, and they move to the first of the Rigidhobbers, for the fourth-speed gear, a small storage bank being built up, as seen at *A* in the feed diagram, Fig. 3. As further pieces are loaded, they are deflected to by-pass the bank and pass to the second machine, where, again, a small bank is formed.

The first component to reach the machine moves into a pivoted pre-load arm, seen at *B* in the close-up view, Fig. 4, which swings over to present the piece to the hydraulically-operated loading arm *C*, of the machine. A close-up view of the loader on the machine is given in Fig. 5. It is a standard unit which has been employed on other Churchill in-line installations of Rigidhobbers and full details, including a sectional drawing, were given in MACHINERY, 90/940—20/4/57. In Fig. 4, a hobbed gear *D* has been deposited on the inner of the three tracks of the conveyor, and the two pivoted jaws of the loader are open ready to receive the next blank. After the jaws have closed, the loading arm rises, swings in a clockwise direction and lowers the blank to the cutting position in the machine. Meanwhile, the pre-load arm moves back to the centre track on the conveyor to engage another blank.

The hobbed piece, deposited on the inner track, is moved until it meets an electro-magnetically operated safety gate, and, upon release, it by-passes the next hobbing machine but is diverted back to the centre track for feeding the next two machines which cut the third-speed gear. As may be seen in the diagram, Fig. 3, the outer track of the conveyor accommodates components which by-pass a storage bank, and pass to the next machine. The loading and unloading mechanism, and starting of the machine cycle are controlled by micro-switches.

With this type of conveyor mechanism, the machines operate individually, and any one of the five can be stopped for tool changing without affecting the remainder. On each machine, the cycle is started automatically when a fresh com-

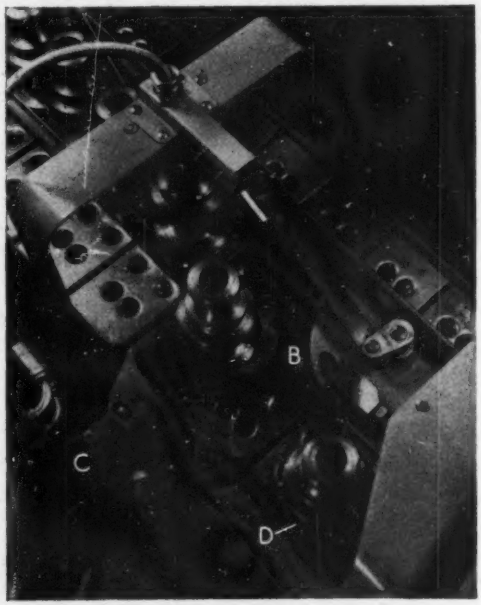


Fig. 4. Close-up view of the pre-load mechanism on the conveyor

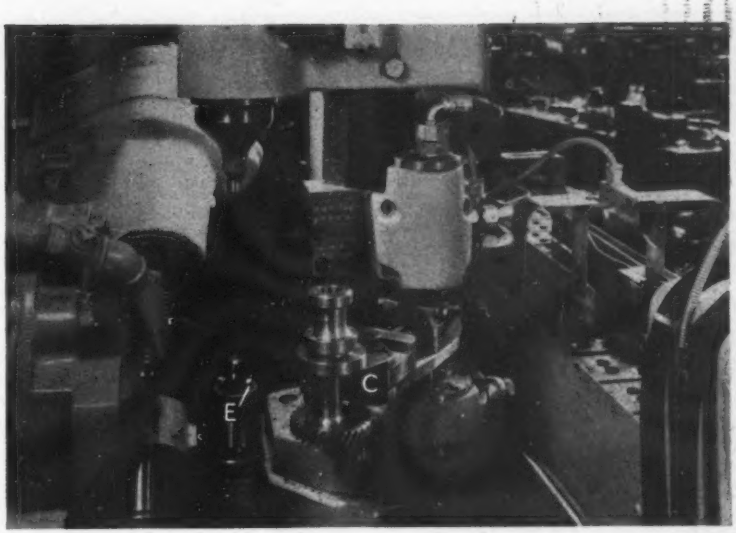


Fig. 5. Arrangement of the hydraulically-operated loading arm on the Rigidhobber

ponent moves into the pre-load arm, and the conveyor storage arrangement enables it to operate for a sufficient length of time to enable tool changing to be carried out on the preceding machine.

Referring to Fig. 5, the work is located on the Rigidhobber by the end chamfers, and is driven by a Kosta driving adapter which incorporates knife-edge, hardened inserts as seen at *E*. Axial pressure to engage the face of the workpiece with these inserts is applied by a cone centre in the hydraulically-operated tailstock. High-speed steel hobs of 3 in. diameter by 4 in. long are used, and are run at a speed of 260 r.p.m. An "O" machine cycle is employed for the helical gears, and a "square" cycle for the 13-tooth spur gear. A feature of the hobbing head is the provision of mechanism for continuous hob shifting through a distance of 3 in., all backlash being eliminated by means of a double, adjustable nut arrangement for the traversing screw of the hob spindle slide.

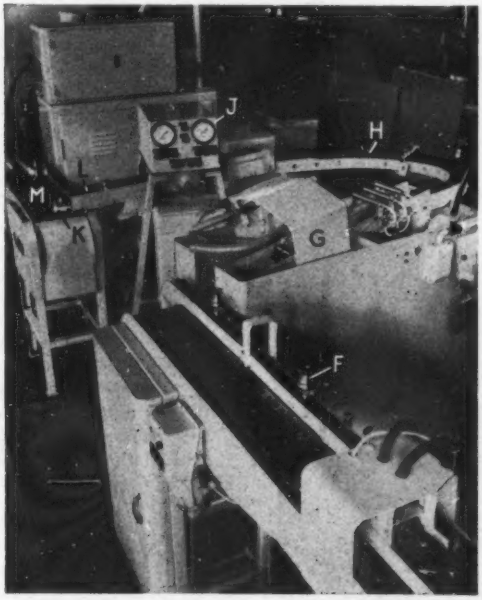


Fig. 6. View of the installation looking in the direction of work movement. The washing and gauging units *G* and *J* are located between the Rigidhobbers and Fellows-England gear shapers

WASHING AND GAUGING HOBBED GEARS

From the battery of Rigidhobbers, the cluster gears pass along the inner track of the conveyor, as seen as *F* in Fig. 1—also in Fig. 6—and at the outlet end they turn through 90 deg. by gravity, to a horizontal position, and roll down short guide rails, to be picked up by carriers on a roller chain in a washing unit *G* of Churchill design. Here, the workpieces pass beneath high-pressure jets of heated chemical cleaning solution, which effectively remove all cutting oil and swarf. The duration of the hot spray, however, is insufficient to raise the temperature of the component to such a point as to preclude accurate gauging, which is performed immediately afterwards. An air jet system dries the work before it leaves the washing unit, to roll by gravity into the curved storage runway *H*, leading to the gauging unit at *J*.

This unit is the first of a new range of automatic gauging equipment developed by the company for use in gear production lines. It incorporates three Sigma pneumatic sensing heads, and a constantly-

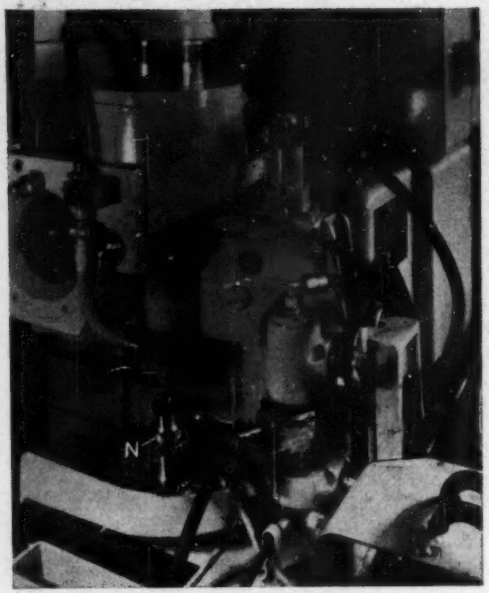
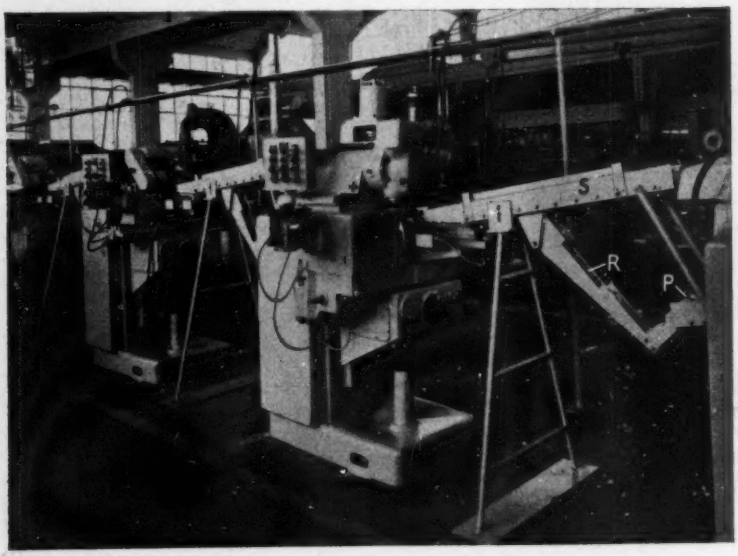


Fig. 7. Arrangement of the hydraulically-operated loading arm on the Fellows-England gear shaper

driven pneumatic valve mechanism controls the automatic cycle. The component to be gauged rolls through an escapement mechanism to the gauging position, where it is located by the bore chamfers between a headstock and a tailstock, which are air-operated.

The three hobbed gears of the cluster are checked for diameter, helix angle and run-out by means of three wedge-type anvils of appropriate pressure angle which are carried on frictionless mountings and have a degree of freedom both to rotate and to move axially. These anvils make contact with the pitch lines of the gears under controlled pressure, over the full width of the teeth. Eccentricity is checked by indexing the workpiece and taking three readings, spaced at 120 deg.

Signal lamps on the control panel of the gauging unit indicate "under-size," "pass," and "oversize" for diameter, and "lead minus," "pass," and "lead plus." One of three signal lamps below is illuminated according to which gear of the cluster is being checked, and another lamp is illuminated when a gear is rejected for any reason. In addition, two 4-in. dials, calibrated to 0·0001 in., display the readings, for setting up and investigation purposes. Upon completion of the gauging operation, the headstock and tailstock retract to release the workpiece, which, if accepted, rolls down the discharge chute *L*, to the next stage. If the component has been rejected by the gauge, a gate in the discharge chute is automatically opened, and the part is directed into a reject chute below the gauging unit. When a pre-selected number of components has passed into this chute, an electrical signal is passed back to the hobbing machine concerned, to stop production pending investigation.



When it reaches the end of the discharge chute *L*, an accepted component moves into a forked arm at *K*, which is pivoted on a horizontal axis. The weight of the gear causes the arm to rotate freely in an anti-clockwise direction, with the result that the gear is deposited on the slat conveyor *M*, associated with three Fellows-England type 7125A

Fig. 8. View of part of the line showing a tooth rounding machine and a chamfering machine which are linked by gravity chutes fed by lifting arms

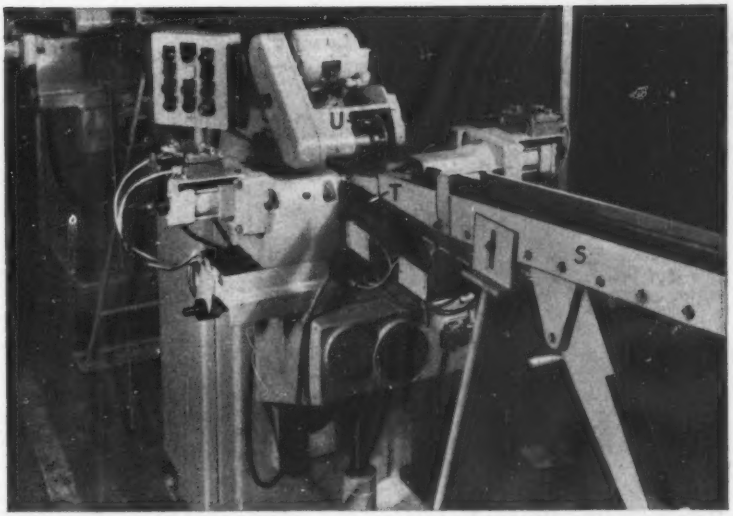


Fig. 9. Close-up view of one of the tooth chamfering machines, which provide for straight-line work flow

high-speed gear shapers (Alfred Herbert, Ltd.), which cut the 18-tooth, second-speed, helical gear. This conveyor, with its selector guide mechanisms, is identical with that which feeds the hobbing machines, and it allows each gear shaper to operate independently, and maintains a supply of parts in storage banks.

The hydraulically-operated loading arms on the gear shapers are of exactly the same design as those employed on the Rigidhobbers, except for a slight modification in the mounting, and the arrangement is shown in Fig. 7, where a workpiece is about to be loaded, for shaping the gear at *N*. A separate pump unit supplies hydraulic oil for the automatic loaders on the three gear shapers, also for work clamping, and for the tailstocks. Clamping is effected by three pads in the workspindle mandrel, which are moved radially outwards to grip the component bore, by means of a cylinder below, after the tailstock centre has moved down and the part has thus been located by the end chamfers. A counter is fitted on each of these gear shapers, and a red warning light is illuminated when a pre-set number of gears has been cut, to indicate that the cutter should be re-ground.

From the gear shapers, the parts pass through automatic washing and gauging units of the type already described, which ensure that the gears cut on the Fellows machines are of the required standard, and the teeth of the first-speed spur gear are then rounded on machines of Churchill design, which represent a new development by the company. Two of these machines are installed, one for each side of the teeth, and they are followed by three machines, also specially designed by the company, which chamfer the helical teeth of the fourth-, third- and second-speed gears. A view of this part of the line, showing the second rounding machine in the centre, and the first chamfering machine on the left, is given in Fig. 8. Each type of machine has an aperture in the column so that a straight-line flow of work can be obtained. A close-up view of one of the tooth chamfering machines is shown in Fig. 9.

The work handling equipment and loading units associated with these tooth rounding and tooth chamfering machines, also with the four Churchill Red Ring gear shaving machines which follow, are air-operated, and of a standardized design. A workpiece, finished on one machine, rolls down a discharge ramp to the position indicated at *P* in Fig. 8, and is picked up in the forked end of an air-operated swinging arm *R*, which deposits it in the gravity feed channel *S*. The latter is fitted with pivoted latches which space the components, and thus prevent damage to the gear teeth.

Referring to the close-up view of the tooth chamfering machine in Fig. 9, also the view of the gear shaving machines in Fig. 10, the workpieces are released, in turn, from the feed channels into U-shaped supports on the end of a loading slide in the unit *T*, which is moved forward by means of an air cylinder to position the piece between the air-operated headstock and tailstock centres of the machine. The outer fingers on the loading slide U-supports are held in the vertical position by means of springs, and are arranged to pivot so that they can retract below the workpiece as the loading slide moves back.

On the tooth rounding machine, the workpiece is rotated and the table is simultaneously reciprocated, the required form being produced by a pencil-type cutter. The latter is carried in a substantial quill, which is rapidly withdrawn to allow the work to be loaded. Upon completion of the

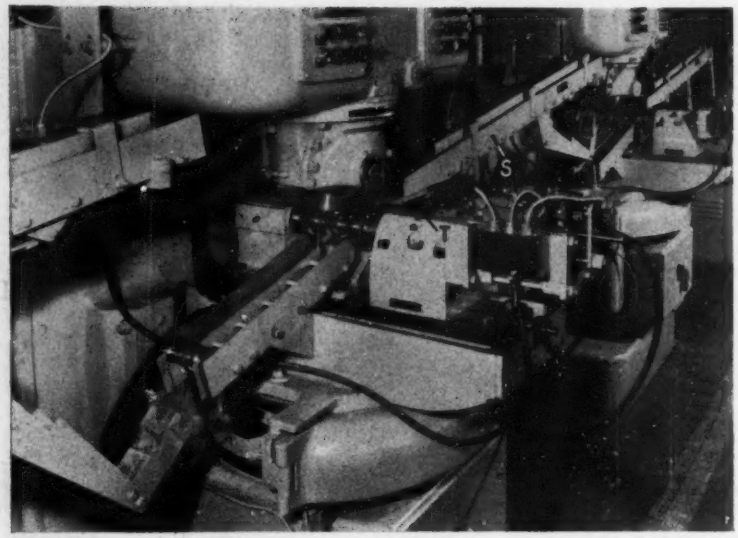


Fig. 10. Arrangement of the Churchill Red Ring gear shavers, which are linked by air-operated loading equipment

operation, the headstock and tailstock centres move back and allow the piece to roll down the discharge chute, whence it is picked up by the swinging transfer arm, as already described.

Chamfering, to remove the acute edges on both sides of the helical teeth, is performed with rotating, disc-type cutters, seen at *U* in Fig. 9. After the workpiece has been loaded between the headstock and tailstock, and meshed loosely with the cutters, the latter move down rapidly into full engagement with the gear, under controlled pressure, and are moved first to the left, and then to the right, to chamfer both sides of the teeth.

After the chamfering operation, the components pass through a brushing machine and a washing unit, and from the discharge channel of the latter they are lifted, by an air-operated arm, into the feed channel of the first of the Red Ring gear shaving machines. As may be seen in Fig. 10, the tables of these machines have been turned through 90 deg., as compared with the normal arrangement, to provide for straight line loading. The machines, known as the type G.C.U., are the first of an improved design, with integrally cast construction for the column, new electrical and pneumatic control gear, and a more efficient cutter-head brake assembly.

In Fig. 10, the arrangement of the discharge channels, swinging transfer arms, and feed channels can be clearly seen. The system provides for banks of

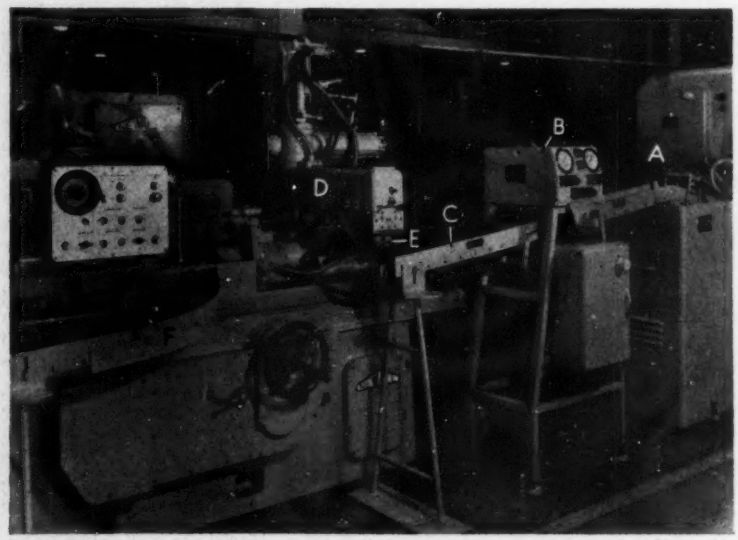


Fig. 11. A view of the end of the machine line showing the final gauging unit and the Newall LA machine which plunge grinds the peripheries of the three helical gears

workpieces at each machine, and micro-switches are fitted which signal the appropriate machine to stop when a feed channel is empty, or full to capacity.

The storage facilities which are provided allow any machine to be stopped for tool changing without affecting the remainder in the line.

On leaving the gear shaving machines, the parts pass through a washing unit and a final gauging station, which are seen at *A* and *B* in Fig. 11. They are of the same design as those employed at other positions in the line, and a pre-set number of rejects causes the shaving machine concerned to be stopped automatically. Accepted parts roll down to a stop position at the end of the discharge channel *C*, and a micro-switch is then operated to start the loading unit *D* on the Newall LA 12 by 24 in. machine, which plunge grinds the outside diameters of the three helical gears. This loading unit is of Newall design and is air-operated. With the jaws *E* open, the arm *D* moves down, and the jaws then close on to the gear at the stop position in the channel *C*. Next, the loading arm rises and swings through 90 deg. in the clockwise direction, and the jaws move to the left, to locate the piece between the machine centres. The workhead is equipped with a Kosta driving centre, and the hydraulic tailstock with a tungsten carbide centre, which is automatically lubricated at each cycle from the oil pump which supplies the wheel-head slide. As soon as the workpiece has been located by the bore chamfers, and gripped between the centres, the loading arm retracts and the plunge grinding cycle starts. This grinding operation is performed to provide locations for the component at the subsequent heat treatment operation, and sizing is obtained by dead-stop, in conjunction with time control of sparking-out by means of a process timer. At the end of the cycle, the tailstock centre retracts, and the finished component rolls down the chute *F*. The two grinding wheels on this Newall machine, one stepped and the other plain, are diamond-dressed automatically, and compensation is made for the reduction in size.

Extensions at Arthur Balfour & Co.

Arthur Balfour & Co., Ltd., Capitol Steel Works, Sheffield, have recently completed a further stage in the extension and development of the steel works and manufacturing facilities at their Greenland Road plant, where it is intended that all production operations will eventually be concentrated. These new developments follow the modernization of the heat-treatment plant which was completed three years ago, when pulverized-coal fired furnaces were replaced by three Gibbons gas-fired annealing furnaces, with mechanical charging equipment. Three more Gibbons furnaces have now been installed, also additional high-frequency melting furnaces, and it is anticipated that the planned expansion scheme will take a further 12 years to complete. The latest extensions were opened recently by Sir Percy Roberts, Bart., M.P., and guests to the ceremony were welcomed by Lord Riverdale, chairman of the company.

The new high-frequency Efco furnaces are of hydraulically-tilted type, with melting capacities

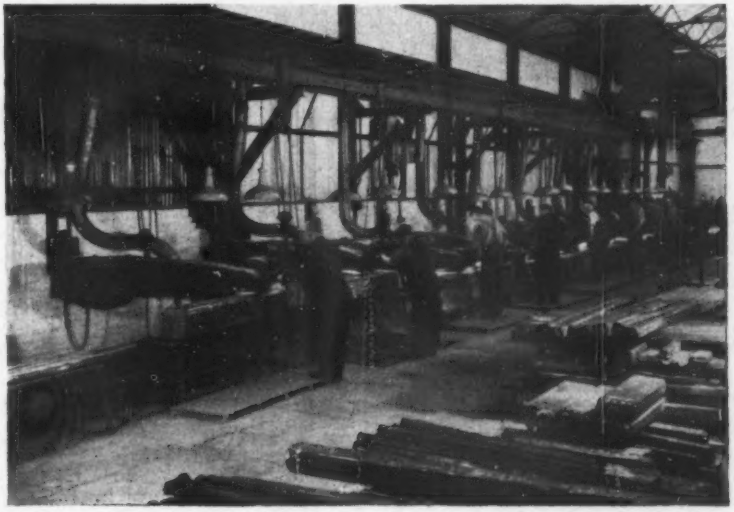


Fig. 1. Part of the billet-grinding shop at Arthur Balfour & Co., Ltd.

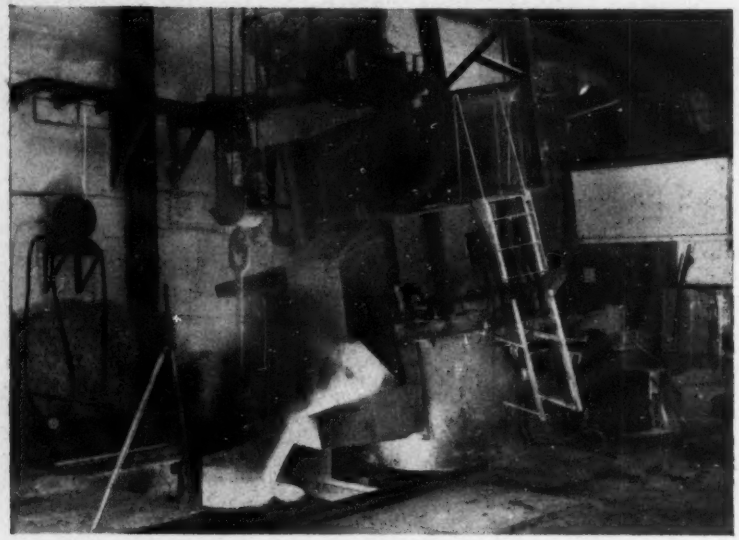


Fig. 2. Pouring an electric arc furnace at Arthur Balfour & Co., Ltd.

of 20 and 10 cwt., and are connected through change-over switches to a 600-kVA. generator. Melting temperatures are recorded by an electronic indicating pyrometer, graduated from 1,200 to 1,750 deg. C. The casting temperature of each heat is recorded on a circular chart, with a specified minimum recording time to avoid false readings. Further temperature checks are taken when the steel is in the ladle, which is carried by a 4-ton crane to a position above the ingot moulds. Every billet used in the production of the firm's tool steel is individually examined to detect surface imperfections, and Fig. 1 is a view of the billet-grinding shop, where special provisions have been made for the removal of grinding dust.

The company's melting technique provides for the injection of oxygen gas into the molten bath in an electric arc furnace, by means of a lance tube, thereby raising the temperature of the melt by at least 200 deg. C. Dense brown fumes of iron oxide and slag particles are formed, which, at one time, were drawn through the roof by fans and discharged into the atmosphere. On moist, windless, days, a large proportion of these fumes remained in the shop for some time, and not only created an unpleasant atmosphere, but made the working of the casting crane hazardous.

Recently-installed dust extraction equipment causes the fumes to be drawn in from the furnace doors and ports by a single inlet fan, with a paddle blade impeller. This arrangement can extract 11,000 cu. ft. of air per min., and is effective even during the most extended lancing periods. It has also made the working atmosphere inside the arc furnace bay almost dust free, and the weight of dust collected for each ton of steel melted is 11 lb., which has a cubic volume of 0·32 cu. ft. One of the arc furnaces is seen in Fig. 2, during pouring operations. A new bay, which is 250 ft. long by 50 ft. wide, will eventually form part of a new factory. This bay provides storage for the steel required by the tool division, and houses materials for the production of a comprehensive range of engineers' tools and hacksaw blades. Horizontal-type storage racks are provided, and sheets, for making hacksaw blades, are stacked on pallets on top of the racks. Bars which are too heavy for manual handling are stored in a position that is convenient for removal by fork-lift truck.

The cutting-off department makes use of hacksaws, bandsaws, parting-off tools and abrasive wheels, depending on the size, grade and shape of cut blanks that are required. Blanks are transferred to an adjacent shotblasting plant or to recently-installed automatic welding equipment. A Birlec electrically-operated furnace, of 2 tons capacity, provides isothermically-controlled annealing treatment, and can be run during the night. A blacksmith's shop is among the other facilities of the new bay. A new electric sub-station has been built on the site, and land is available for the erection of five more 50-ft. wide production bays.

Hacksaw blades have been produced by the company for nearly 40 years, and plant has recently been installed for the making of metal cutting bandsaws, some of the machinery being of the firm's own design. Bandsaws are made from bright-finished, cold-rolled steel strip, in coils up to 600 ft. in length. An early operation in the production sequence is milling the teeth, and teeth are cut on 20 lengths of strip at a time. This operation is followed by tooth setting, tooth hardening, tempering, measuring and cutting to length. Bandsaws are supplied in coil or in welded loops.

News of the Industry

Keighley

LANDIS LUND, LTD., Cross Hills, have a good programme of Precimax plain and universal cylindrical grinding machines in hand, also fine boring machines. Many of these machines are destined for the motor car industry and others for overseas customers. One of the firm's largest cylindrical grinding machines, with a capacity for work up to 28 in. diameter by 100 in. long, has recently been despatched to Iraq. Among the special-purpose machines on order are angle-head types, also oval piston and camshaft grinders. Rotary table surface grinders of 20-, 25-, and 40-in. capacity, in hand, include machines destined for India. A recently-completed 25-in. diameter rotary machine has 12-in. depth capacity under the grinding wheel, as compared with the normal 7 in.

In the works we noted fine boring machines in progress of the single- and double-ended types, with single and multiple spindles. Our attention was drawn to a batch of three fine borers, with automatic loading, for motor car change-speed gears. We hope shortly to describe a 3-spindle, single-ended, machine which has been built for operations on diesel engine 6-cylinder blocks, also the firm's latest 20/25-in. rotary table surface grinding machine. An Archdale vertical spindle milling machine with 54-in. table traverse has recently been added to the plant.

Eventually, these works are to be extended and additional plant installed to facilitate the production of Landis automatic cam, crank, and multi-wheel grinders, and Gardner double-disc precision grinders.

DEAN, SMITH & GRACE, LTD., are fully occupied with the production of standard centre lathes ranging from 13- to 30-in. swing, surfacing and boring lathes from 13- to 24-in. swing, and 17-in. swing toolroom lathes with built-in relieving equipment. Hydraulic copying attachments, of the type described in MACHINERY, 92/1465—20/6/58, are being fitted to some of the lathes in progress. Export business in hand includes orders from Commonwealth countries.

WARD, HAGGAS & SMITH, LTD., have lathes ranging from 6½- to 10½-in. centres and planer-shapers of 36 in. stroke in progress. Among other work on order we noted a special 60-in. centre lathe, and a 60-in. swing sufacing and boring lathe.

D. MITCHELL & CO., LTD., are doing a steady trade in lathes of 8½- and 12-in. centres, with beds of various lengths, for customers both at home and abroad. A new folder has been issued describing the firm's type DM8 lathe, of 8½-in. centres, with 12-speed all-geared headstock. This lathe has a 3¾-in. diameter spindle bore, and will swing work up to 32 in. diameter by 11½ in. wide in the gap. At the associated DARLING & SELLERS works, lathes of 10½-, 14½-, and 16½-in. centres are in progress, and N. HARGREAVES & CO. are occupied with the building of 6½-in. centre lathes, on both home and export account.

KEIGHLEY GRINDERS (MACHINE TOOLS), LTD., report a well-maintained demand for both standard and special plain, universal, gauge, angle-head and internal cylindrical grinding machines, and export business is in hand for India, Australia and Canada. There is an increasing call for special machines or standard machines with special equipment. Among the former, we noted a double-head, automatic, external cam grinder arranged for automatic loading, and automatic external grinding machines, also with automatic loading, for special components. Since our last visit, additions to the plant have included a Dean, Smith & Grace centre lathe, a Taylor-Hobson Talysurf surface measuring machine, and an O.M.T. optical inclinable table.

A. FIELDING & CO. (KEIGHLEY), LTD., in addition to 16- and 18-in. swing centre lathes, for customers at home and abroad, are engaged in the building of special boring and milling heads, portable locomotive cylinder boring bars, pipe flange facing machines, and other special-purpose equipment.

VERNIERS (KEIGHLEY), LTD., are experiencing a steady call for precision instruments such as vernier calipers and height and depth gauges, of various sizes, and repair work is also being undertaken on this type of instrument. The design and production of jigs, fixtures, gauges and press tools are also undertaken, and in this connection we may note orders from the aircraft industry. Among new developments may be mentioned a range of sine tables, of simple and compound types, with T-slotted surfaces or equipped with magnetic chucks; indicator gauge stands; and sine bar type

bench centres, admitting 12 in. between centres, with 4¾-in. swing, and 20-in. roller centres. A spring-loaded centre permits rapid loading and release of work.

HEWITT & TOPHAM, LTD., Ingrow, are experiencing a steady call for the cutting of spur, bevel and worm gears, also for bevel and worm reduction units and stock cast iron and steel mitre gears. A Sykes 10-in. spur gear generating machine has recently been installed.

H. B.

Gauge and Tool Makers

At a trade luncheon held recently at the Savoy Hotel by the Gauge and Tool Makers' Association, Standbrook House, 2-5 Old Bond Street, London, W.1, the president, Mr. F. W. Halliwell, C.B.E., M.I.Mech.E., M.I.Prod.E., introduced the Guest of Honour, Mr. Ross Roy, president of Ross Roy, Inc., Detroit, Mich., U.S.A. After making reference to other distinguished American visitors who had addressed them at previous luncheons, and to the visit of a delegation from the Greater Detroit Board of Commerce in 1950, Mr. Halliwell expressed their gratification that Mr. Ross Roy, who was the immediate past-president of the Board, had made the journey from Detroit for the express purpose of accepting their invitation. He went on to emphasize the importance of a sustained and growing volume of world trade, and indicated that, despite the "rosy picture" of our national economy which the newspapers were painting, this was no time for relaxation. "One thing is quite certain," he continued, "if, in this country, our manufacturing industries are to keep ahead of foreign competition and develop and expand, as indeed they can, more and better tooling is needed. The tooling industry has strikingly shown at its recent exhibition that it stands equipped and ready to provide just that."

Mr. Ross Roy's subject was: "How can British and American business best meet the Soviet economic challenge?" After outlining the nature of the challenge, he went on to make three recommendations for action on the part of Britain and the United States. First, he suggested, the nations of the free world could best meet the Soviet threat by being more willing to compete with each other. He was not advocating any such policy as the selling of subsidized goods, but "more of the kind of competition that has made us strong nations"—the competition of the market place, and to this end we should lead the way towards freer trade.

In this connection—and this was the second point—businessmen should help to shape and support government economic policies which encouraged freer trade between the free nations. He believed that more action was needed on the part of businessmen and less on the part of government. At present, the businessman who was most vocal against nationalization of industry and strong central government, was often the first to run to government for protection against competition—both domestic and foreign.

More specifically, Mr. Ross Roy contended, the United States, with the help of Great Britain and the other free nations, should lead the way in removing economic barriers to trade between the free nations. The responsibility of the United States was, perhaps, greater than that of Britain, but he was convinced that with more concerted action far more could be accomplished than if we went our separate ways.

Mr. L. E. Van Moppes, chairman of the Association, proposed the toast of "Our Guests" and The Rt. Hon. Lord Riverdale of Sheffield, a member of the Dollar Export Council, responded.

New Factory for Sandvik Swedish

In 1951, Sandvik Swedish Steels, Ltd., the United Kingdom-based associate company of Sandviken Jernverks, A.B., Sweden, decided to supply customers from extensive stocks maintained in this country, and as a further step in the implementation of this policy a new factory was recently opened at Halesowen, near Birmingham. Built at a cost of £250,000, the factory has come into operation during the centenary year of the parent company in Sweden, and provides a works area of 27,000 sq. ft., with allowance for expansion by a further 20,000 sq. ft. The office accommodation amounts to slightly more than 18,000 sq. ft., and, here again, provision has been made for future expansion.

The works are divided into two main sections, comprising a storage block and a machine shop, and the former holds more than 7,000 different items at present, each individually packed and classified. To overcome the problem of corrosion, the company has developed a method of protecting the various items by the application of a transparent plastics film, which facilitates handling and is clean to the touch.

Manufacture of the company's well-known range of tungsten carbide tools will be carried on in these new works, and a general view of the machine shop, showing some of the equipment provided for this purpose, is given in the accompanying figure. When all the equipment has been installed, there will be a total of 45 machines engaged on this type of work. It is planned to increase the range of tool shapes to include those of circular form, also



General view of the machine shop at the new factory of Sandvik Swedish Steels, Ltd., which was opened recently at Halesowen, near Birmingham

more intricate tools to customers' special requirements.

In addition, a larger volume of semi-finished products will be imported from the parent company in Sweden for finishing operations in this country. These semi-finished products include tubing, strip, and wire, and it is stated that large stocks of cold-rolled steel strip are maintained, in standard mill widths, which can be sheared and edge-dressed to customers' specifications. A special department has been set up for the production of machine clicking knives for the shoe and glove industries, also for use by plastics and textile manufacturers. These knives, which are made from steel strip approximately 1 in. wide, with one or both edges sharpened, are formed to the required shape by means of special bending rigs and templates, and the company has made arrangements to provide the rapid delivery which is frequently stipulated for such tools, in view of the seasonal nature of the work for which they are required.

Obituary

MR. T. H. KAYE died recently at the age of 69. He was a director of Rose, Downs & Thompson, Ltd., Hull, until his retirement in 1956, after 53 years' service with that firm.

MR. SAMUEL BOTTAMS died on October 3 after a short illness. Formerly with Rolls-Royce, Ltd., and Ford Motor Co., Ltd., Mr. Bottams had for some time been in business on his own account.

Trade Publication

GRATON & KNIGHT, LTD., Boreham Wood, Herts. The fifth edition of this company's Graknight V-belt drive manual has been issued. It includes tables of increased horse-power ratings for Raycord V-belts, particulars of additional sizes now included in the list of standard V-belts, information on a new "fast service" for V-pulleys, and details of the Bushlok V-pulley. The V-drive design section has been rearranged and the data are concisely presented.

DOWDING & DOLL, LTD., 346 Kensington High St., London, W.14. Catalogue listing accessories available for use with the range of British-built Wiedemann turret punch presses which they handle. These accessories include double jaw work holders, minus dimensioning equipment, guided punches, a template punching tool unit and a centre punch unit, die holder set-up fixtures, punch holder hangers, and tool storage cabinets.

BX PLASTICS, LTD., Higham Station Avenue, Chingford, London, E.4.—Booklet entitled "Injection Moulding Materials," which illustrates the very wide range of components that can be manufactured by the injection moulding process, and gives details of various materials employed.

The Need for Reducing Drawing Office Time

(*Continued from page* 975)

largely on the nature of the accommodation and the extent of the facilities provided, and in these respects, it is believed, there is often much to be desired. The advantages of the draughting machine and the universally-adjustable drawing board, for instance, have long been established, but such equipment is not yet employed on anything like the scale that would be justified. Important benefits could also be derived from the wider use of photo-copying techniques and such equipment as adding and calculating machines.

As compared with the requirements of the toolroom or manufacturing departments which it serves, the needs of even the most efficient drawing office are very modest, and economies in this respect are likely to be increasingly dearly bought as automation, both in the production lines and in tool-making, advances.

Industrial Notes

THE AEROGRAPH CO., LTD., 47 Holborn Viaduct, London, E.C.1, have recently changed the name to THE AEROGRAPH-DEVILBISS CO., LTD. There has been no alteration to the address or trade mark

FRED FERRARIS (CLERKENWELL), LTD., have moved their sales, technical and administrative offices to Northampton Square, Ashby Street, Clerkenwell, London, E.C.1 (telephone number, Clerkenwell 2676-7).

STUART DAVIS, LTD., Much Park Street, Coventry, inform us that their exhibit of pneumatic valves and cylinders on the Engineering Centre stand at the Brussels Universal and International Exhibition was awarded a gold medal.

TUBE PRODUCTS, LTD., are now making electric resistance welded tubes up to 5½ in. diameter, at their Falcon Works, Wednesfield, on a mill of their own design. These tubes can be produced with wall thicknesses up to ¼ in. and lengths up to 60 ft.

EXPENDITURE ON PLANT AND MACHINERY by manufacturing industry (at current prices) amounted to £308·4 million during the first half of this year. In the corresponding period of 1957 the total was £303·1 million, and in the full year, £622·4 million.

ADAM ENGINEERING CO., LTD., 4 Grange Street, St. Albans, Herts., have appointed the following representatives for their machine tools: Pakistan—Mr. Rahimtoola, Akmo Buildings, 1 West Wharf Road, Karachi. India—Mr. D. K. Mitra, 15a Narendra Nath Ghose Lane, Calcutta, 40.

ORDERS FOR MACHINE TOOLS during July were valued at £5,572,000, including £1,856,000 for export. Deliveries during the month totalled £7,016,000, of which £1,622,000 was for export. At the end of July the value of orders in hand was £64,298,000 (including £16,610,000 for export) as compared with £89,134,000 at the end of July, 1957.

ASSOCIATED ELECTRICAL INDUSTRIES, LTD., have recently concluded negotiations with W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., for the purpose of amalgamating the cable and other manufacturing facilities of the two companies, and will, on agreed terms, purchase the whole of the issued capital of the latter company.

OTTERMILL SWITCHGEAR, LTD., inform us that the extensions to their factory at Ottery St. Mary, Devon, were officially opened recently by Mr. Robert Mathew, T.D., M.P. It is now eight years since the company moved from their premises in Acton, London, and during that period the number of employees has risen from 80 to more than 200.

A MOBILE DISPLAY UNIT at present being operated by J. A. Crabtree & Co., Ltd., Walsall, Staffs., carries a representative selection of the company's wiring accessories, miniature circuit-breakers, and motor control gear. The unit is being employed not only to supplement the exhibitions which the company hold in various towns, but to bring the products to the attention of those unable to attend the exhibitions.

SELF-CHANGING GEARS, LTD., Lythalls Lane, Coventry, are now publishing a quarterly house journal entitled Transmission Times. Well-presented and illustrated, the first issue includes interesting articles concerned, for example, with the latest diesel train transmission with torque converter, modernization on British Railways, electronic testing of gearboxes, and automatic transmissions on the Continent.

HUNTER (LONDON), LTD., 80 Fenchurch Street, London, E.C.3, announce that the Hunter Universal truck has been modified to enable it to carry all types of industrial X-ray equipment. Provision is made for raising the X-ray head to the required height, and, in addition, the X-ray machine can be rotated through 360 deg. in both the horizontal and vertical planes. This development, it is claimed, greatly facilitates such operations as the X-raying of high-pressure boilers, also fuselage and wing seams in aircraft.

ALEXANDER KENYON & CO., LTD., suppliers of a wide range of engineers' and contractors' stores and tools, are celebrating their centenary this year. The occasion has been marked by the official opening of the company's new headquarters Akenco House, Elizabeth Street, Manchester, 8. This modern building covers an area of 40,000 sq. ft. on a 2-acre site, and includes a showroom of 10,000 sq. ft. in which the entire range of products handled by the company can be displayed.

KEELAVITE ROTARY PUMPS & MOTORS, LTD., inform us that the name of the company has been changed to KEELAVITE HYDRAULICS, LTD., but that the address (Allesley, Warwickshire) and telephone number, remain unaltered. It is felt that the new name indicates more clearly the activities of the firm, and takes into account the amalgamation with a number of other companies, and the recently-announced plans for expansion. When the new London-Birmingham road is opened, the factory will have a frontage on it.

A NEW HIGH-SPEED ELECTRONIC COMPUTER is now in process of construction at the main Hayes factory of E.M.I. Electronics, Ltd. Known as the EMIDEC 2400, the computer is designed to employ components of British manufacture exclusively, and will be suitable for such applications as the handling of invoicing, stock control, and accounting systems, also the production of standard business letters. The Multiplexing unit of this computer will be on show on the company's stand at the forthcoming Electronic Computer Exhibition at Olympia.

THE INSTITUTION OF PRODUCTION ENGINEERS, 10 Chesterfield Street, London, W.1, has recently published a classified bibliography entitled "The Effect of Technological Progress on Education." This bibliography, which does not claim to be comprehensive, is intended to serve as a guide to the development of technical education during the period covered (1945 to 1957), also as a summary of opinion on that subject. Copies are available from the Publications Department of the Institution at the above address, price 2s. 6d. (or 3s. 6d. by post).

THE BRITISH CAST IRON RESEARCH ASSOCIATION, Alvechurch, Birmingham. In the annual report of the Association for 1958 reference is made to current investigations which are being undertaken by the Research Department of the mechanical properties of cast iron, soundness of iron castings, moulding and core sands, analytical techniques, white and chilled cast irons, malleable cast iron, and other matters. Notes are also included on the activities of the Development Department, the Foundry Operations Section, and the Intelligence Department.

THE INCANDESCENT HEAT CO., LTD., Smethwick, have recently been awarded a contract valued at more than £500,000 for a large coil annealing installation at the new steelworks of the Sociedad Mixta Siderurgia Argentina (SOMISA). The equipment ordered comprises 25 single stack coil annealing furnaces with 72 bases, 32 forced cooling hoods, and three exothermic gas atmosphere plants each rated at 10,000 cu. ft. per hour. The furnaces will be built to the design of the Lee Wilson Engineering Co., Inc., Cleveland, U.S.A., for whom Incandescent are manufacturing licensees.

INDUSTRIAL BUILDING.—Provisional figures issued by the Board of Trade show that 512 Industrial Development Certificates were issued during the third quarter of this year for new industrial buildings and extensions for manufacturing industry totalling 12,500,000 sq. ft. These figures relate to buildings and extensions with individual areas exceeding 5,000 sq. ft. For the second quarter the number of certificates was 499, and the area, 10,800,000 sq. ft. In the full year 1957, 2,422 certificates were issued for a total area of 63,900,000 sq. ft., and the corresponding figures for 1955 were 2,470 and 71,600,000 sq. ft.

BRYCE BERGER, LTD., are to move from their present factory, adjacent to the works of Petters, Ltd., Staines, which is no longer adequate in view of the expansion in the range of products, to the Gloster Aircraft factory of the Hawker Siddeley Group at Hucclecote. The move will begin in about two months' time, and approximately six months will be required for its completion. Supplies to customers will not be interrupted. PETTERS, LTD., will take over the Staines factory and will absorb the productive labour new employed there, also a proportion of the non-productive and technical staff. This company will in future make some of the engines previously produced by J. & H. McLaren, Ltd., also the small engines produced by Armstrong Siddeley Motors, Ltd., at Brockworth.

AN EXHIBITION OF INDUSTRIAL X-RAY EQUIPMENT is being held at the showrooms of Marconi Instruments, Ltd., 23-25 Station Square, Harrogate, and will continue until November 1. The comprehensive display includes equipment suitable for applications ranging from the laboratory to the shipyard, of both transportable and static types. A unit for the direct visual inspection of small parts by X-ray fluoroscopy is being shown, also the Marconi image amplifier, whereby an image can be produced which is considerably brighter than that seen on a conventional fluoroscopic screen. A comprehensive range of English Electric welding electrodes is on view, and a section is devoted to measuring instruments of particular interest to industry.

Tool Manufacturers Annual Dinner

The National Federation of Engineers' Tool Manufacturers held their annual dinner at the Connaught Rooms, London, on October 21, and the president, Major-Gen. E. P. Readman, C.B.E., T.D., welcomed more than 200 members and guests, including representatives from kindred trade associations. The principal guest, Mr. F. Bower, C.B.E., president of the Association of British Chambers of Commerce, proposed the toast " the National Federation of Engineers' Tool Manufacturers," and wished them continued success in their important field. Sir Stanley J. Harley, vice-president of the Federation, responded.

Personal

MR. H. T. STILLWELL has resigned his position with F.U. (London), Ltd. He informs us that he will be entering into other activities in the near future.

MR. E. MIDDLETON, works manager of Beard & Fitch, Ltd., 60 Britton Street, Clerkenwell Road, London, E.C.1, recently completed 50 years' service with the company. To commemorate the occasion, a presentation was made by Mr. C. T. Beard, the managing director, in the presence of the employees and staff. When Mr. Middleton started work with the firm, they occupied premises at nearby Goswell Road, and the " labour force," which now numbers about 40, consisted of Mr. Beard, Mr. Middleton, and two others.

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29/10/58

Rolling Mill for Thin Foil

In the article published in MACHINERY, 93/557—3/9/58, describing the installation for the production of alloys of high purity at the Metal Division of The Telegraph Construction & Maintenance Co., Ltd., Crawley, Sussex, reference was made to a rolling mill for very thin metal strip. Since it might be thought that this mill is in commercial production, we have been asked to point out that it has only been built for experimental work. The mill is based on the designs of Mr. G. W. Lord, of the Post Office Research Station, Dollis Hill, London, N.W.10, and has not been used for other purposes. It is understood that the patent rights are owned by the National Research Development Corporation.

Sir Alfred Herbert Scholarships

Mr. R. G. Francis and Mr. B. D. Lancaster, who were awarded travelling scholarships under an arrangement made by the late Sir Alfred Herbert, were each presented with a diploma and a medal at a luncheon given recently by the Machine Tool Trades Association. Mr. Francis, who is at present employed in the electrical drawing office of Alfred Herbert, Ltd., undertook a tour of leading electrical firms in this country; Mr. Lancaster, who is with Humber, Ltd., studied the production and application of machine tools in general, and visited four leading firms in this country, as well as a large machine tool firm and two motor car manufacturers in Western Germany.

Under the terms of the awards, which are open to students of Coventry Technical College, both recipients made reports of their visits to the M.T.T.A.

N.P.L. Apprenticeships

A well-presented, illustrated booklet has been issued by the National Physical Laboratory, Teddington, Middlesex, as a guide to engineering apprenticeships in the Laboratory. Following an explanatory foreword, sections are devoted to recruitment, training, education, and the work of the apprentice training committee. Attention is also drawn to the opportunities open to those who have served apprenticeships.

Materials Handling Convention

The fifth in the series of materials handling conventions organized by the Materials Handling Group of the Institution of Production Engineers was held recently at the Hotel Metropole, Brighton.

This event differed from those of previous years, in that small groups of delegates visited various firms engaged in a variety of industries in the Brighton area, with the object of observing, at first hand, their materials handling arrangements. Delegates were thus afforded an opportunity of discussing, with methods and production engineers of the host firms, problems associated with materials handling for their particular products. In their reports, the groups of delegates gave their opinions on the efficiency of the handling arrangements inspected, and made particular reference to any suggestions for improvement which had arisen from their discussions with engineers at the works visited.

Subjects for visits and discussion comprised problems of handling containers, cases and packages; large articles for batch production; and small articles for mass and batch production; also problems associated with the maintenance of product quality, and with parts of awkward shape.

Proposed Merchant Organization

A meeting will be held at the Waldorf Hotel, London, W.C.2, on November 4, at 2.30 p.m., at which machinery merchants will meet to decide whether to form a national organization to safeguard their interests. It is pointed out that such an organization may be particularly desirable in view of the proposals for a European Common Market. The suggested organization would not be intended to compete in any way with others which are well established, such as the British Association of Machine Tool Merchants and the Contractors' Plant Association.

Machinery merchants are invited to send representatives to the meeting and copies of the agenda and the proposed terms of reference for the organization can be obtained from Mr. C. W. Allen, F.C.C.S., F.R.S.A., 100 Park Street, Grosvenor Square, London, W.1. (telephone number Mayfair 7086).

Taylor-Hobson Exhibition

Taylor, Taylor & Hobson, Ltd., Leicester, will hold an exhibition of precision measuring equipment and engraving/milling machines and accessories at the Grand Hotel, Charing Cross, Glasgow, C.3, from November 17 to 22, inclusive, from 10.30 a.m. to 7 p.m. daily (November 22, 9 a.m. to 12.0 noon).

Exhibits which will be demonstrated will include the CX engraving machine and the JH engraver/miller; the Talysurf surface measuring instrument; the Micro alignment telescope; and Talymin gauges.

B.E.M.A. Technical Information Service

In the latest issue of the Bristol and West of England Manufacturers' Association Bulletin, it is announced that the Association is proposing to increase the range of their existing services to the engineering industry in the area by the provision of a technical information service. This service will be operated in conjunction with the Department of Scientific and Industrial Research, which will appoint a liaison officer for the area, with whom the B.E.M.A. will maintain close contact.

The Association is to receive a grant from the D.S.I.R., under the Conditional Aid Scheme, and with the exception of enquiries which necessitate a measure of original research it is anticipated that the new service will be offered free of charge. Attention is drawn to the advantages which are to be gained from having access to the published results of research carried out by a large number of establishments, covering a wide field of subjects.

Drawing for Service Equipment

On the authority of the Joint War Production Committee of the Ministry of Defence, the Engineering Standards Co-ordinating Committee has prepared Defence Specification No. DEF-33, which, in giving recommendations for drawing procedure for Service equipment, is intended to be supplementary to B.S.308:52, concerned with drawing practice. This new specification requires the preparation of a comprehensive series of drawings, and associated lists, in a logical sequence and a standard form, setting out and making reference to all the technical information necessary to enable manufacture and inspection to be undertaken with the assurance that such work will conform to the Service requirements.

It is intended that drawings for all Service equipment shall be prepared in accordance with the requirements of this specification, copies of which can be obtained from Her Majesty's Stationery Office, price 7s. 6d.

Coming Events

INCORPORATED PLANT ENGINEERS INSTITUTION. General meeting. November 4, at 7 p.m., at the Royal Society of Arts, John Adam Street, Adelphi, Strand, London, W.C.2; paper on "Operational Research and the Plant Engineer," by G. D. Jordan, M.Eng. *Peterborough Branch.* November 4, at 7.30 p.m., at the White Lion Hotel, Church Street, Peterborough; paper on "The Clean Air Act," by J. Hall.

INSTITUTION OF MECHANICAL ENGINEERS. Ordinary Meeting in conjunction with the Industrial Administration and Engineering Production Group. November 7, at 6 p.m., at the Institution, 1 Birdcage Walk, London, S.W.1; paper on "Economic Design of Light Alloy Castings," by P. A. Broadbent. *Yorkshire Graduates' Section.* November 6, at 6.30 p.m., in the Engineering Department, Sheffield University; paper on "The Changing Pattern of University Courses in Engineering," by F. C. Turner.

INSTITUTION OF ELECTRICAL ENGINEERS. *South Midland Centre.* November 3, at 6 p.m., at the James Watt Memorial Institute, Great Charles Street, Birmingham; paper on "Some Impressions of Technical and Industrial Training in the United States,." by K. R. Sturley, Ph.D., B.Sc.

INSTITUTION OF PRODUCTION ENGINEERS. *Halifax and Huddersfield Graduate Section.* November 5, at 7.30 p.m., at the Percival Whitley College of Further Education, Halifax; lecture on "Electronic Control of Machine Tools," by R. P. Gardner. *Nottingham Section.* November 5, at 7 p.m., at the Reform Club, Victoria Street, Nottingham; lecture on "Moulding Processes for Thermoplastics Materials," by L. W. Turner. *Liverpool Graduate Section.* November 4, at 7.30 p.m., at the Radiant House, Bold Street, Liverpool, 1; lecture on "Servo Mechanisms," by C. Pomfrett. *Reading Section.* November 6, at 7.30 p.m., at the Canteen, Transport Equipment (Thornycroft), Ltd., Basingstoke; lecture on "Making Jigs, Tools and Moulds in Epoxide Plastics," by P. G. Pentz, B.Sc. *Dundee Section.* November 5, at 7.30 p.m., at the New Imperial Hotel, Tally Street, Dundee; lecture on "Powder Metallurgy," by G R. Bell, B.Sc.

Scrap Metals

†LONDON.—‡Prices per ton for non-ferrous scrap metals free from iron are as follows:—clean copper wire, untinned and free from lead and solder, £192; clean heavy copper, untinned and free from lead and solder, £183; copper, wire, No. 2, £178; clean light copper, £167; braziery copper, £150; gunmetal, £153; brass, mixed, £107; lead, net, £61; zinc, £32; cast aluminium, £94; old rolled aluminium, £112; battery lead, £33; unsweated brass radiators, £98; hollow pewter, £500; black pewter, £370.

MIDLANDS.—General trading in the Midlands is still very difficult except in cast-iron scrap. This material is now in demand and competition has improved prices.

Unfortunately, demand for heavy steel is at a minimum and merchants' stocks continue to rise. As much of this scrap as possible is sheared to 18-in. lengths for supply as "short steel," but foundry markets, also, are accepting only limited deliveries and supplies exceed requirements.

Stocks of chipped turnings at merchants' yards are now excessive, as tonnages accepted by blast furnaces fall far below the output from Midlands factories. Bushy turnings are still difficult to move, but a few tons are being delivered each week direct to a Midlands steelworks.

Light steel scrap is being moved steadily and accumulations are being reduced as more No. 4 bundles are required in South Wales and Sheffield.

Current maximum control prices, delivered consumers' works, are now: *Heavy steel No. 1, 217s. 6d.; *heavy steel No. 2, 196s.; *heavy steel No. 4, 207s. 6d.; *heavy steel No. 5, 195s. 6d.; light iron No. 8, 149s.; short turnings No. 9 (free from alloy), 167s. 3d.; light steel No. 11, 164s. 3d.; bushy turnings, 117s.; short alloy turnings, 160s. 9d.; short steel No. 2, 233s. 3d.; machinery cast, 233s.

Prices may be increased up to 2s. 6d. per ton according to quantities tendered over a given period.

* For use by Round Oak Steelworks, Brierley Hill, increase by 1s. 6d. per ton.
† George Cohen, Sons & Co., Ltd., 600 Commercial Road, E.14.
‡ Subject to market fluctuations.

Corrections

In the advertisement for Thos. P. Headland, Ltd., Melon Road, S.E.15, on p. 137 of MACHINERY for October 22, the "material wastage per cut" for the Startrite-Meba horizontal cut-off bandsaw was compared with that which resulted from the previous method. The figures were given as 0·825 and 1·6 "cut" ins., and this should have read 0·825 and 1·6 cubic ins.

In the advertisement for Boneham & Turner, Mansfield, Notts, which appears on p. 130 of this issue of MACHINERY reference is made to "tab washers and shims or regular shapes." This should read "irregular shapes."

In the advertisement for Carobronze, Ltd., School Road, Belmont Road, London, W.4, on p. 141 of this issue of MACHINERY, the telephone number and telegraphic address are given incorrectly. The number should be Chiswick 0245 and the telegraphic address Carobronce, Chisk, London.

Newman Industries Developments

Newman Industries, Ltd., Yate, Bristol, as part of their expansion programme, have opened a new London stockroom in Monckton Street, Kennington, S.E.11. Various machines and equipment for which the company hold sole selling rights in the United Kingdom are on view, and others will shortly be displayed. Items now available or inspection, by arrangement with the London manager, Mr. E. A. W. Whitehead (telephone number Sloane 8206), include Heid copying lathes and planer drive units, Technoimpex centre lathes and milling machines, and Strojexport vertical and centreless grinders.

The company has recently been appointed sole agent in the United Kingdom for Rocco boring and milling machines, and Somua milling machines. These latter machines are now being built in this country by Birfield Tools, Ltd.

Machine Tool Share Market

Very active conditions prevailed in most sections of the stock markets during the period under review, and although the general tendency was irregular, the underlying tone remained firm.

The gilt-edged section, however, was mainly quiet, and for the most part quotations for British Funds drifted to lower levels owing to persistent small selling, and kindred issues also lost ground.

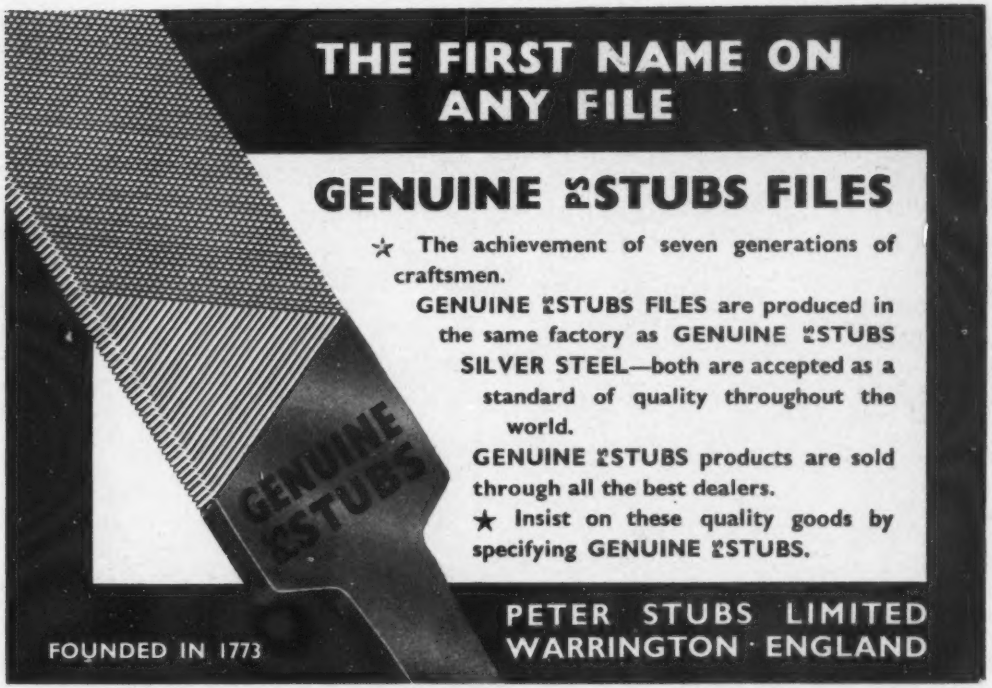
Trading in the commercial and industrial share sections remained at a high level and a satisfactory tone was maintained. While some irregularity in price movements was shown, the majority of changes were favourable on balance, and many good features were in evidence.

Among machine tool issues, Edgar Allen advanced 6d. to 36s.; Asquith Machine Tool, 6d. to 22s.; Newman Industries, 6d. to 2s. 9d.; Birmingham Small Arms, 9d. to 32s. 6d.; British Oxygen, 1s. 6d. to 44s. 6d.; Broom & Wade, 3d. to 13s. 6d.; Chas. Churchill, 4½d. to 5s. 6d.; Coventry Gauge & Tool, 9d. to 17s.; Sheffield Twist Drill, 9d. to 13s. 6d.; Greenwood & Batley, 1s. 10½d. to 52s. 6d.; John Harper, 1½d. to 15s. 10½d.; and Thos. W. Ward, 1s. 6d. to 87s. On the other hand, Craven Bros. (Manchester) lost 1½d. at 8s. 3d.; B. Elliott, 3d. at 3s.; John Holroyd "A," 3d. at 12s. 6d.; and Martin Bros. (Machinery), 4½d. at 2s.

KAYSER ELLISON & Co., LTD.—Final dividend 15 per cent, plus a bonus of 5 per cent, making, with the interim, a total distribution of 25 per cent (same).

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	9d.
Armstrongs, Stevens & Son, Ltd.	Ord.	5/-	8/3
Allen (Edgar) & Co., Ltd.	Ord.	£1	36/-
" "	5% Prf.	£1	15/3*
Arnott & Harrison, Ltd.	Ord.	4/-	15 6
Asquith Machine Tools Corp., Ltd.	Ord.	5/-	22/-
" " "	6% Cum. Prf.	£1	18/6
Birmingham Small Arms Co., Ltd.	Ord.	£1	32/6
" " "	5% Cum. "A" Prf.	£1	15/6
" " "	6% Cum. "B" Prf.	£1	18/-
" " "	4% 1st Mort. Deb.	Stk.	88½
British Oxygen Co., Ltd.	Ord.	£1	44/6
" " "	6½% Cum. Prf.	£1	22/-
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	3/10½
Broom & Wade, Ltd.	Ord.	5/-	13 6
" "	6% Cum. Prf.	£1	17/9
Brown (David) Corporation Ltd.	5½% Cum. Prf.	£1	15/6
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/9
Butler Machine Tools Co., Ltd.	Ord.	5/-	8/-
" " "	5% Cum. Prf.	£1	13/9
C.V.A. Jigs, Moulds & Tools, Ltd.	5½% Red. Cum. Prf.	£1	11/3
Churchill (Charles) & Co., Ltd.	Ord.	2/-	5/6
" " "	6% Cum. Prf.	£1	26/4½
Churchill Machine Tool Co., Ltd.	Ord.	5/-	18/1½
" " "	6% Cum. Prf.	£1	18/3
Clarkson (Engrs.), Ltd.	Ord.	5/-	15/-
Cohen (George), Son & Co., Ltd.	Ord.	5/-	11/-
" " "	4½% Cum. Prf.	£1	14/6
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	17/-
" " "	5% Cum. Red. Prf.	£1	16/3
Coventry Machine Tool Works, Ltd.	Ord.	4/-	8/6
Craven Bros. (Manchester), Ltd.	Ord.	5/-	8/3
Elliott (B.) & Co., Ltd.	Ord.	1/-	3/-
" "	4½% Red. Cum. Prf.	£1	13/9
Expert Tool & Case Hardening Co., Ltd.	Ord.	2/-	1/3
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	12/6
Greenwood & Batley, Ltd.	Ord.	£1	52 6
Harper (John) & Co., Ltd.	Ord.	5/-	15/10½
" "	4½% Red. Cum. Prf.	£1	12/10½
Herbert (Alfred), Ltd.	Ord.	£1	36/3
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	12 6
" "	"B" Ord.	5/-	12/3
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	22/-
" " "	7% Cum. Prf.	5/-	5/-
Kayser, Ellison & Co., Ltd.	Ord.	£1	46 6
" " "	6% Cum. Prf.	£1	18/3
Kendall & Gent, Ltd.	Ord.	5/-	7/-
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	6/3
Kitchen & Wade, Ltd.	Ord.	4/-	8/3
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/-
Massey, B. & S., Ltd.	Ord.	5/-	9/-
Modern Engineering Machine Tools Ltd.	Ord.	5/-	10/7½
Newall Engineering Co., Ltd.	Ord.	2/-	4/9
Newman Industries, Ltd.	Ord.	2/-	2/9
" "	6% Prf. Ord.	5/-	5/6
Noble & Lund, Ltd.	Ord.	2/-	3/9
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	21/-
" " "	5½% Cum. Prf.	£1	25/9
Pratt (F.) & Co., Ltd.	Ord.	5/-	22/6
Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	5/6
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	43/6
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	14/1½
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	13/6
" " " "	5% Cum. Prf.	£1	15/-
Stedall & Co., Ltd.	Ord.	5/-	7/6xd
	"B" non-voting Ord.	10/-	22/-
Sykes (W. E.) Ltd.	Ord.	5/-	8/-
Tap & Die Corporation, Ltd.	4½% Deb. 1961-1977	Stk.	82/-
" " "	Ord.	10/-	18/9
Wadkin, Ltd.	Ord.	£1	87/-
Ward (Thos.) W.), Ltd.	5% Cum. 1st Prf.	£1	16/-
" "	5% Cum. 2nd Prf.	£1	24/-
Willson Lathes, Ltd.	Ord.	1/-	2/4½

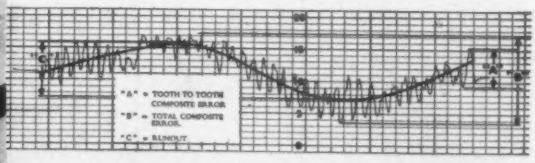
The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. † Birmingham price.



PF22



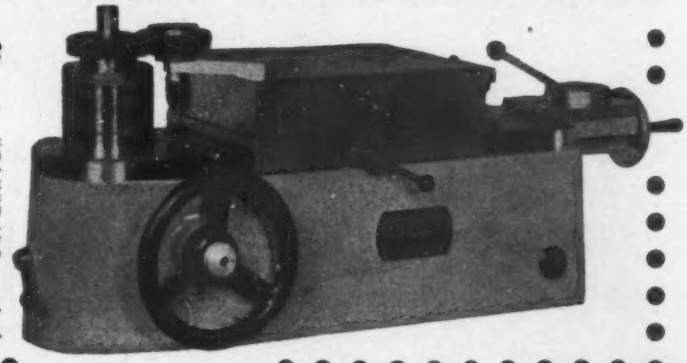
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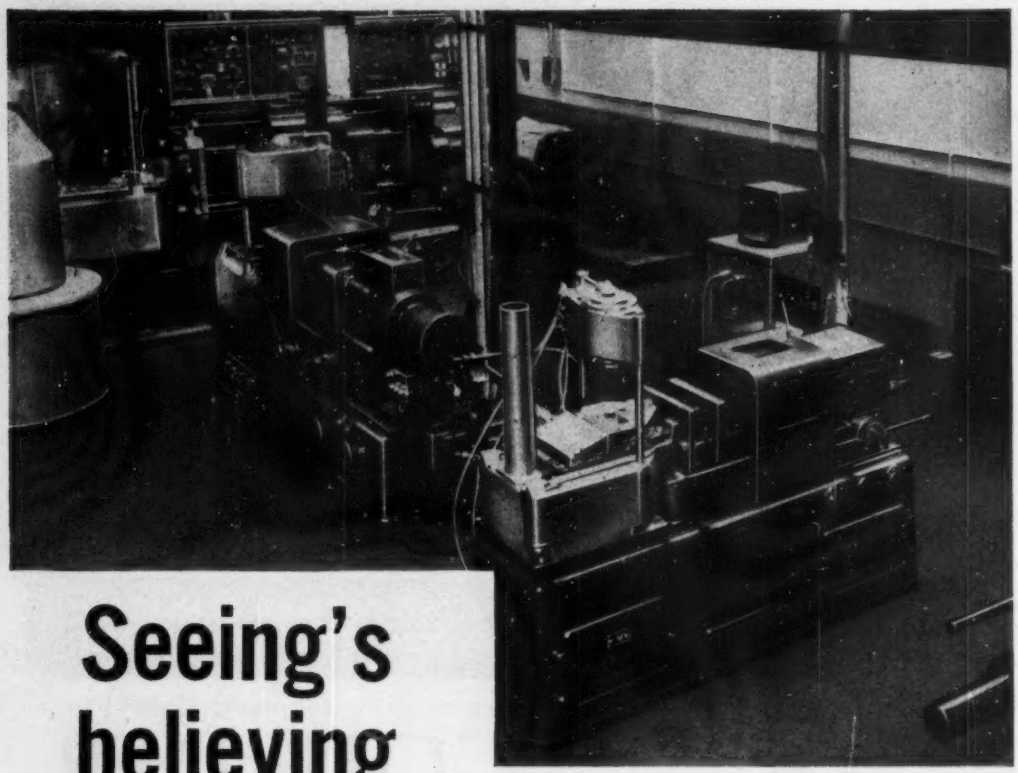
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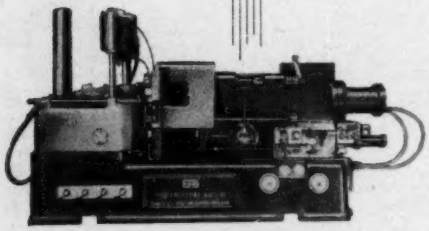
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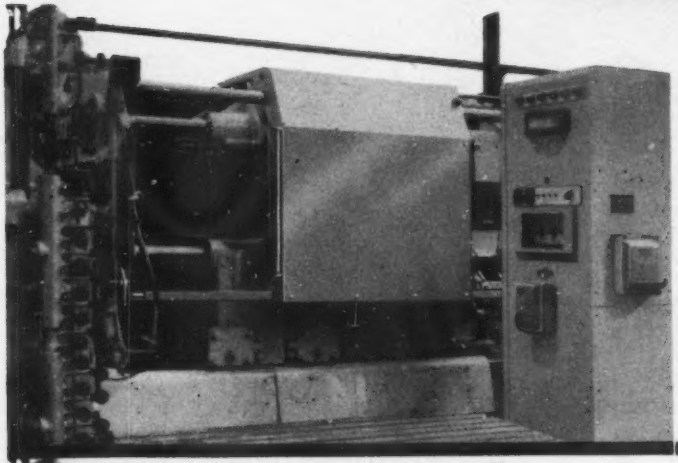
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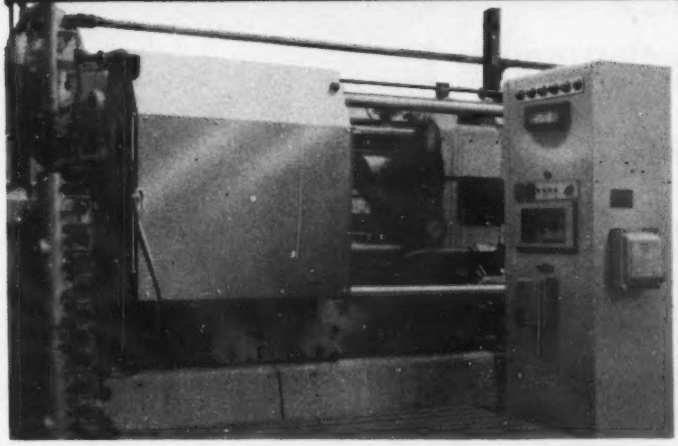
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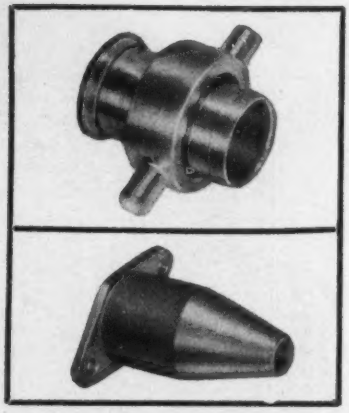
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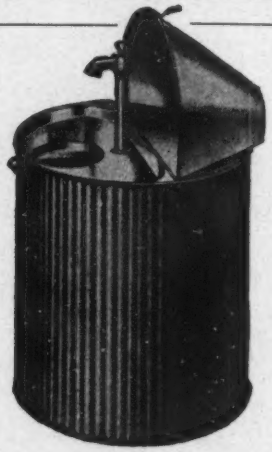
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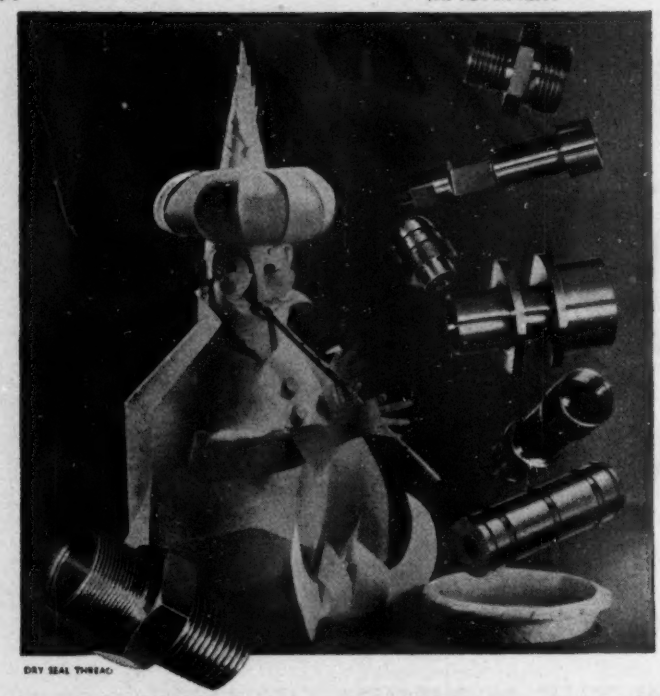
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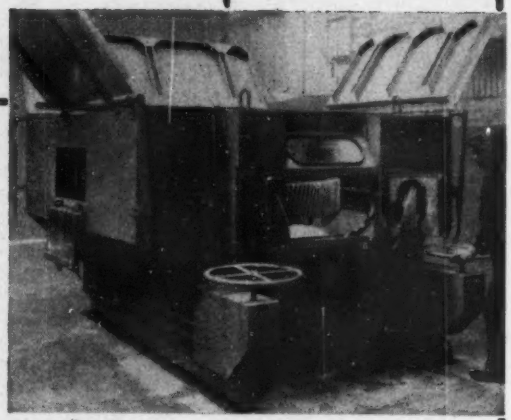
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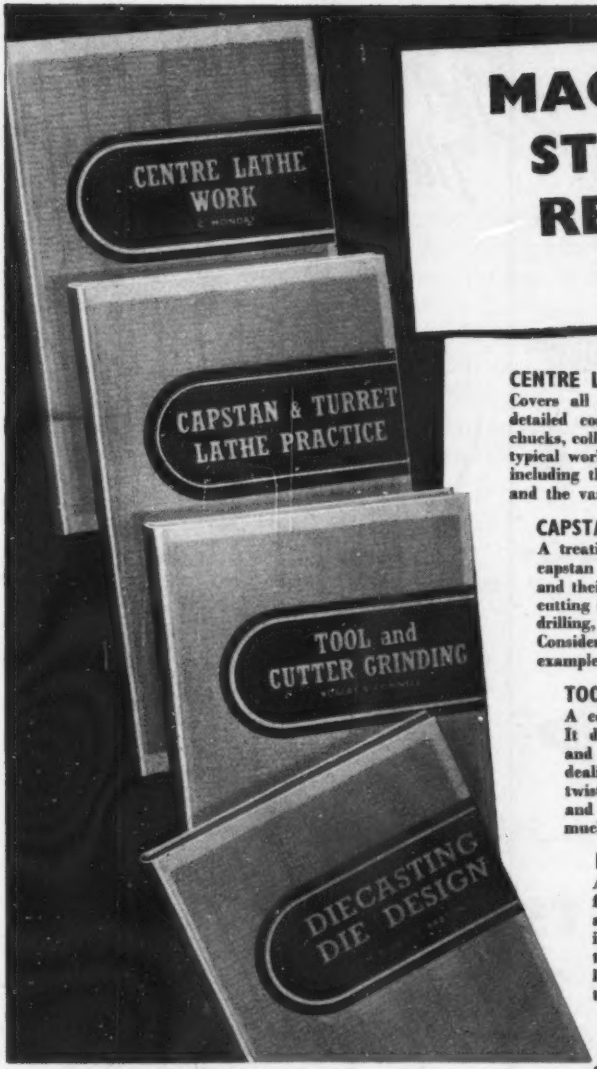
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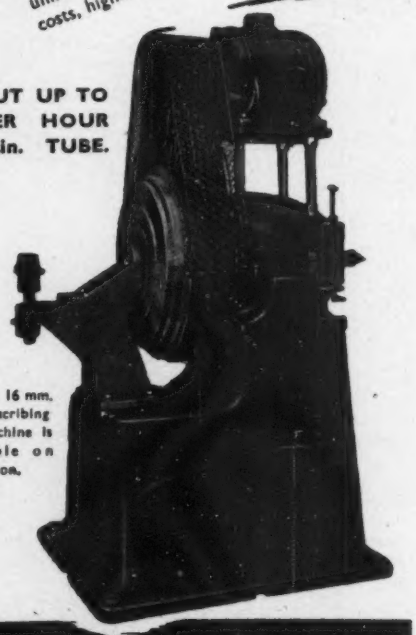
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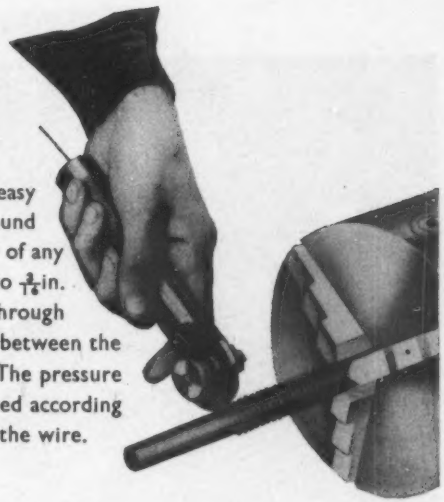
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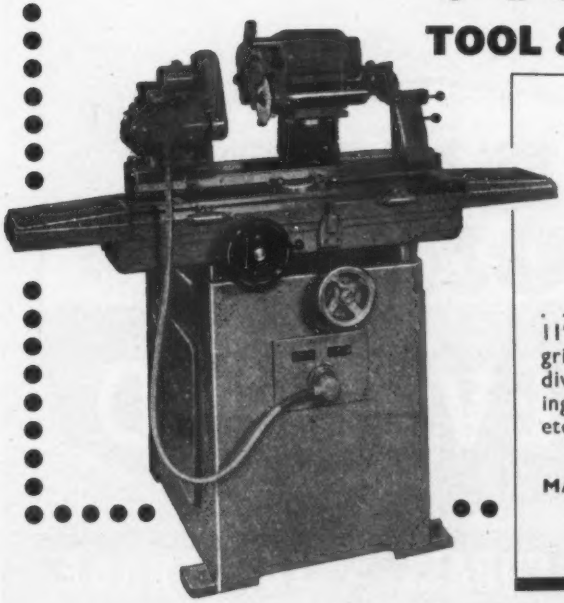


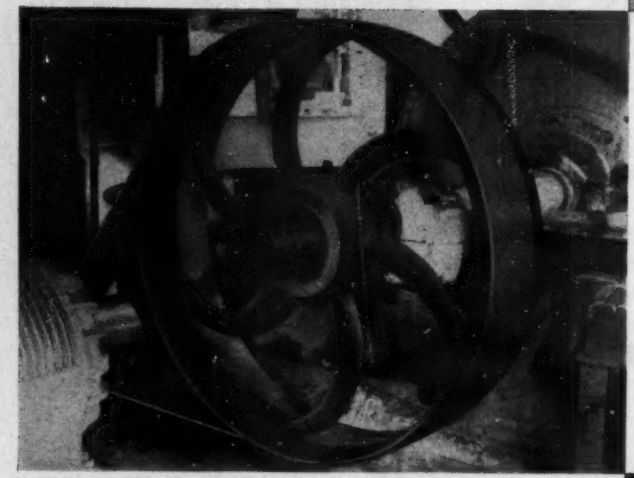
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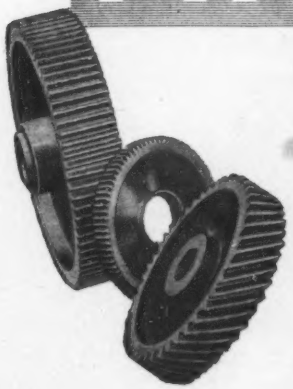
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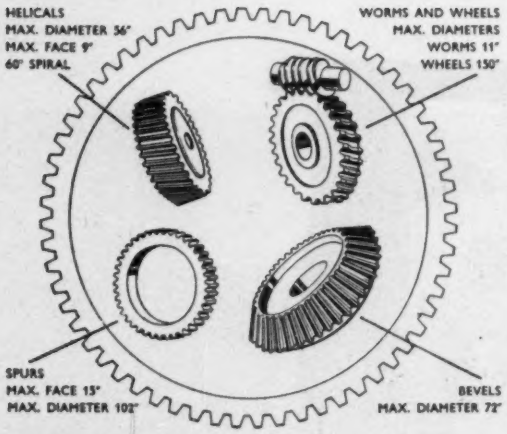
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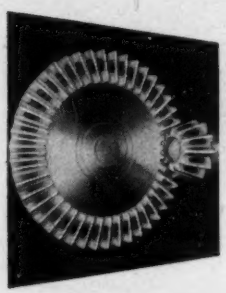


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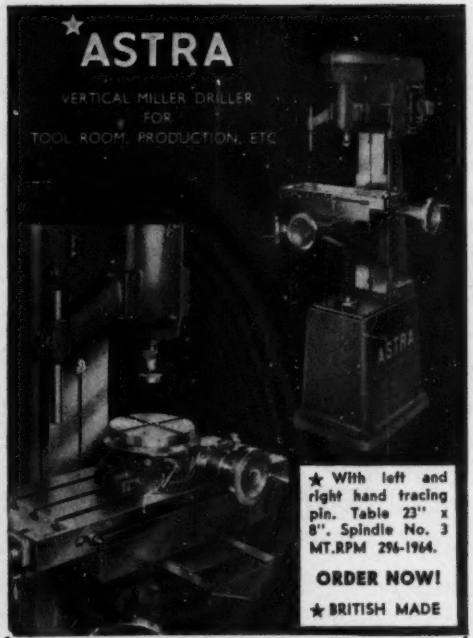
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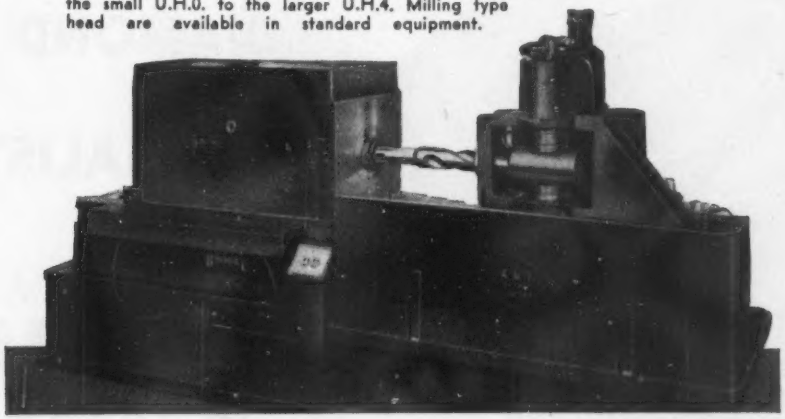
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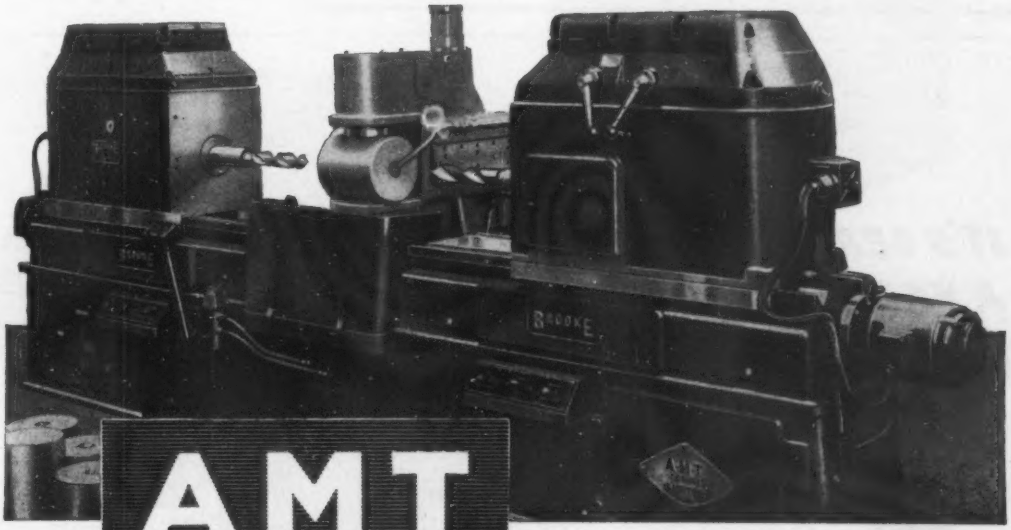
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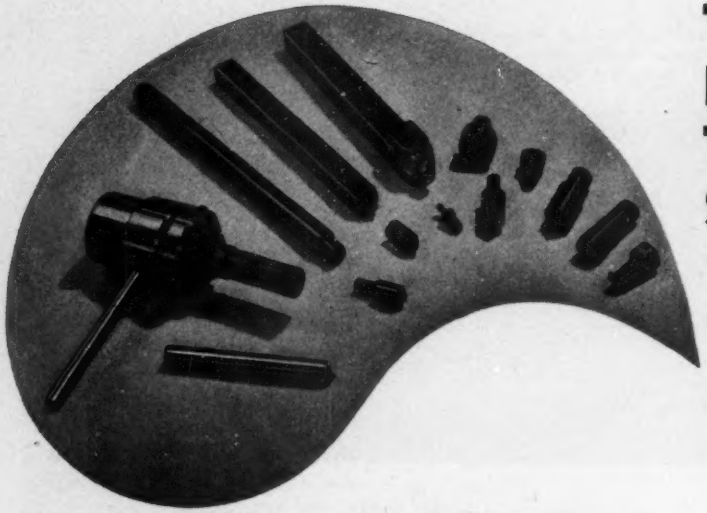
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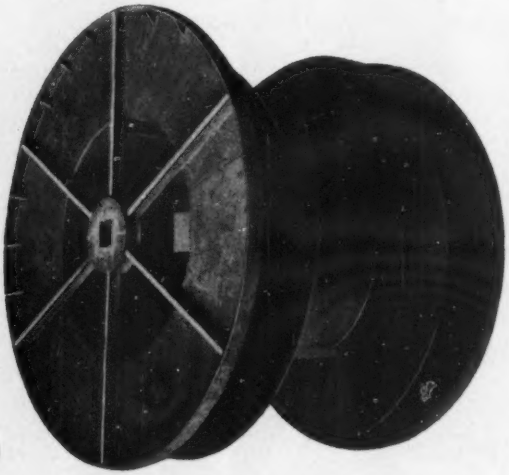
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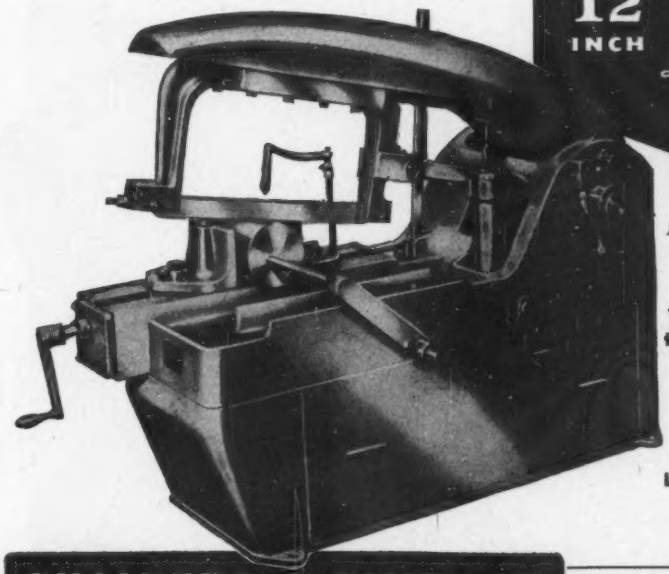
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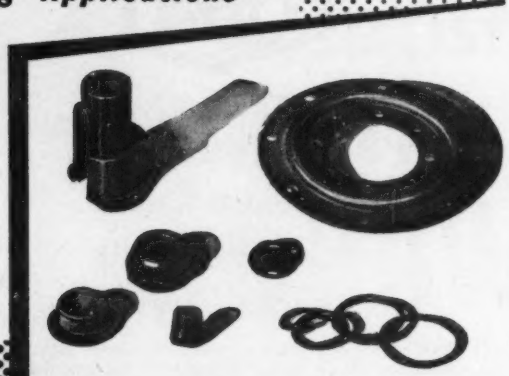
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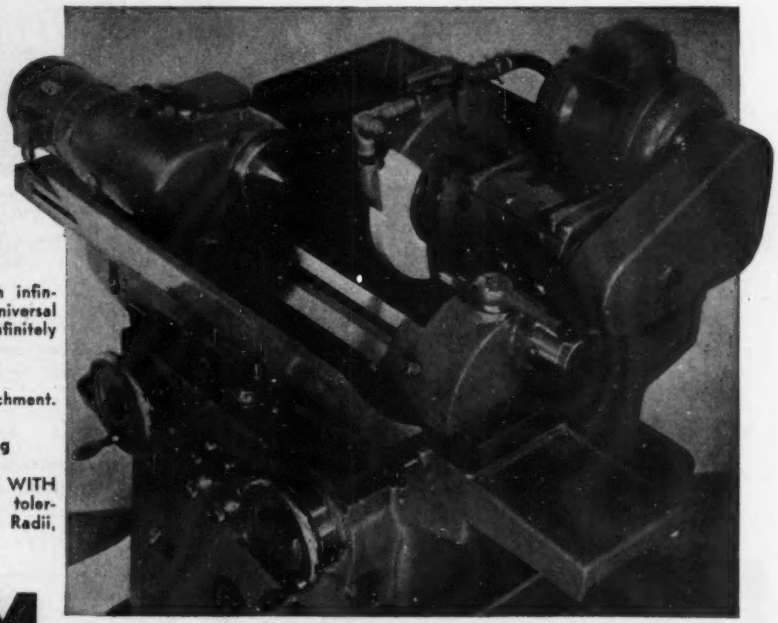
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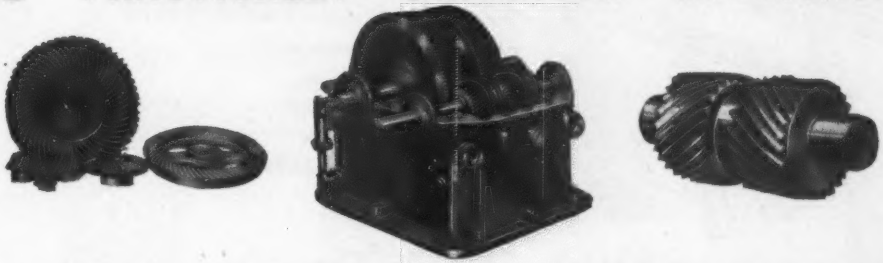
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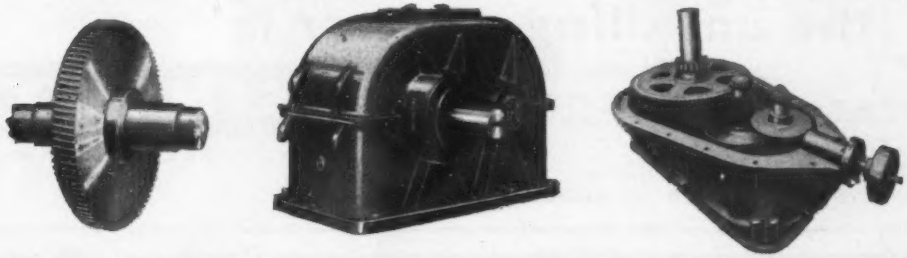
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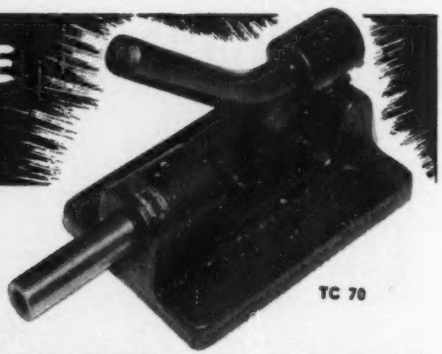
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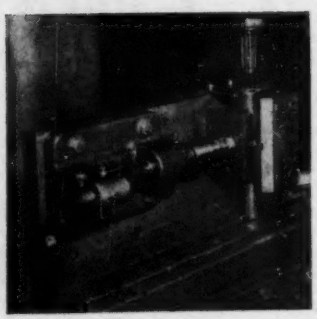


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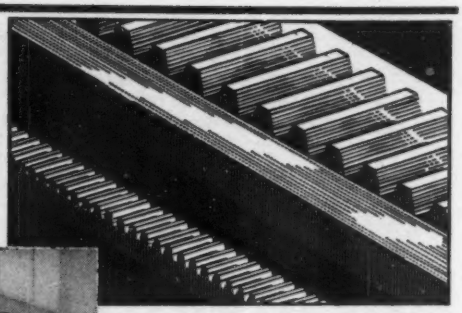
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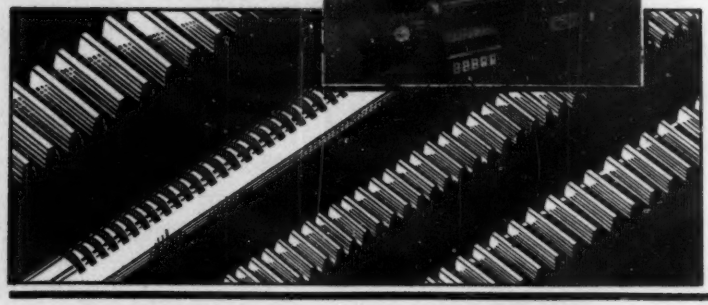
Rack supplied from 16 D.P. to 1¼ D.P. and corresponding circular and metric Pitches. Accuracy and high quality finish guaranteed. Complete supply of blanks available, but customers' material used, if preferred.

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Precision bench surface grinding machine

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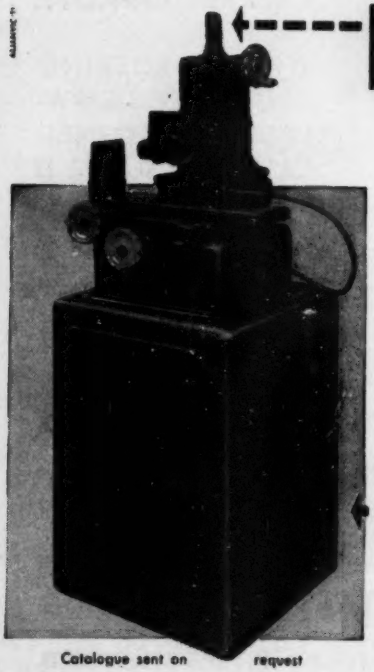
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HEIGHT 125 mm

Surface of magnetic chock :
105 x 152 mm.

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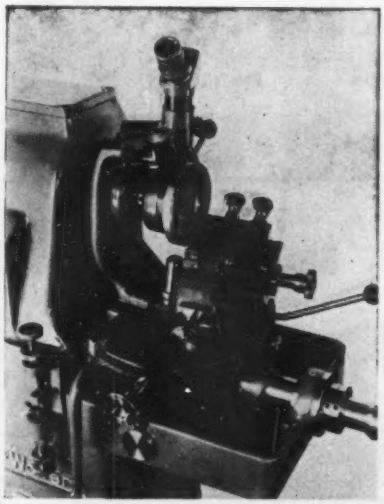
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TOLERANCES WITHIN ·00004in. SURFACE FINISH 1 MICRO-INCH OR LESS

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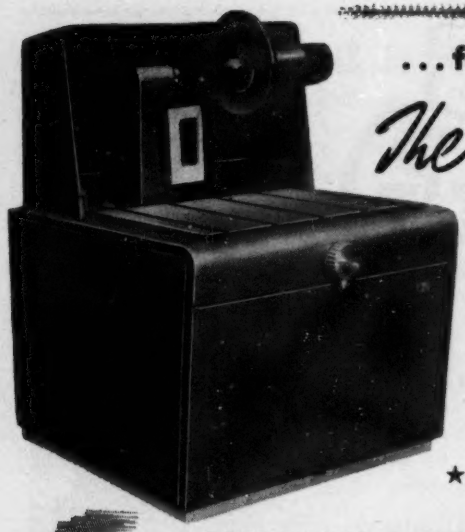
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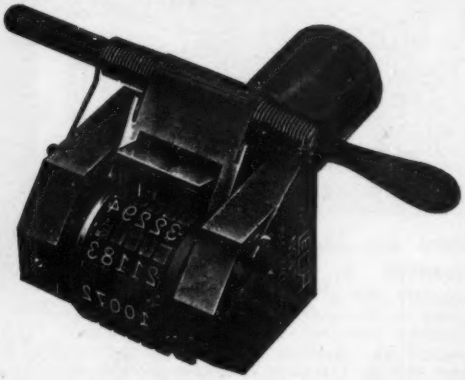
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Close-up showing dividing attachment on rotary table

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The machine above is available in two sizes, with 6½" and 8½" strokes. It possesses many features of the toolroom model described above but is intended primarily to accommodate the many jobs which do not require such extreme accuracy and versatility.

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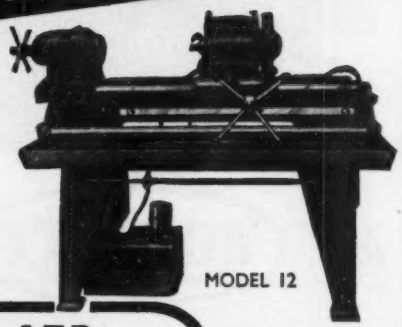
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Model 12	6″	5″	20 – 140 sec.	,,

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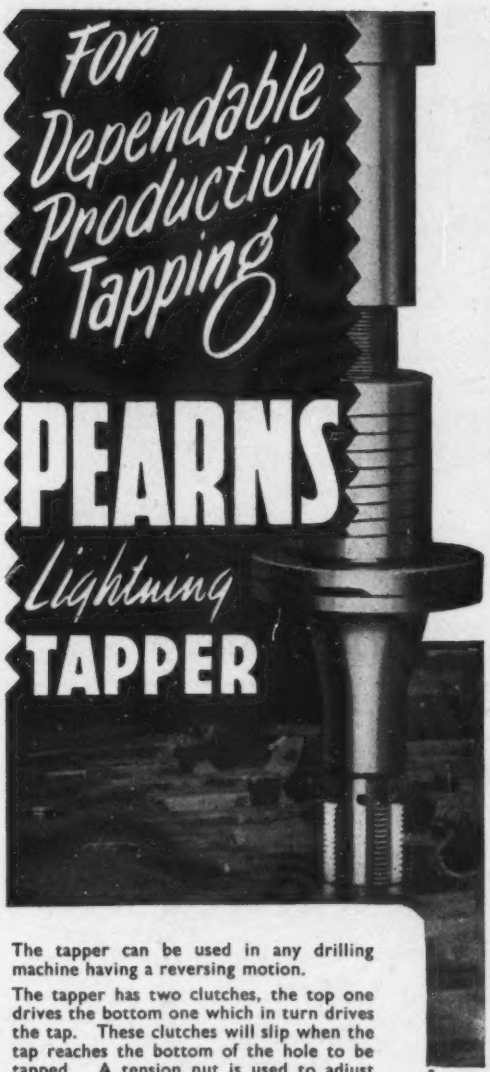
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TAPPER



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The tapper has two clutches, the top one drives the bottom one which in turn drives the tap. These clutches will slip when the tap reaches the bottom of the hole to be tapped. A tension nut is used to adjust the pressure of the spring acting on the clutches which slip when too heavy a load comes on the tap and prevents it breaking.

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"B" capacity $\frac{1}{2}$in. to $1\frac{1}{4}$in.
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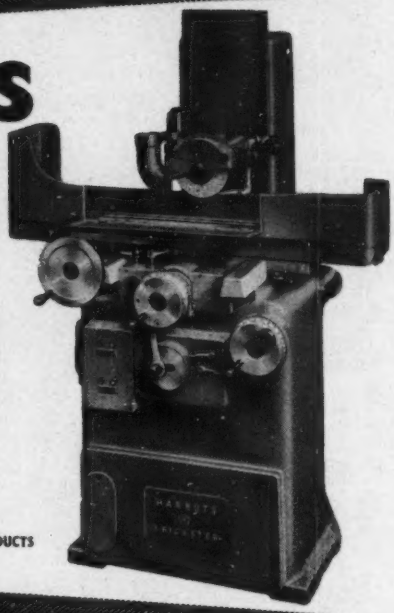
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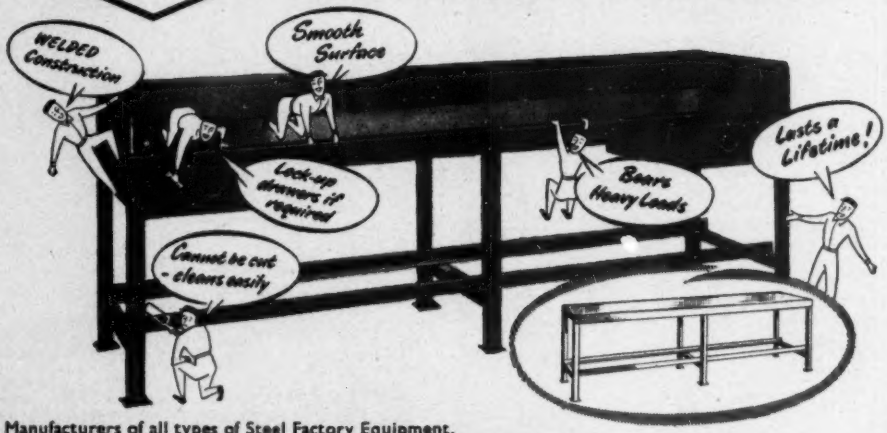
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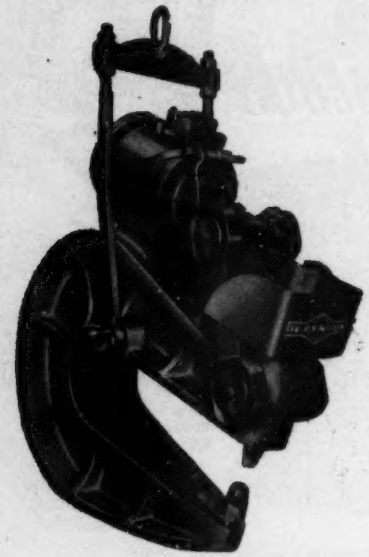
This new company will be completely independent and will function under the same works management with Mr. J.H.W. HAYES as its Managing Director.

We appreciate most sincerely the support we have received from our friends during the recent difficult months and we look forward to a continuance of their valued support.

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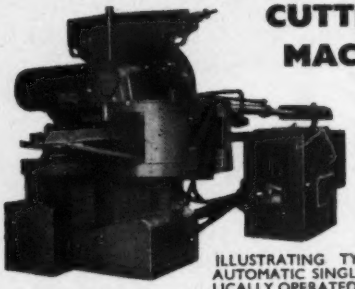
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CUTTING-OFF MACHINES



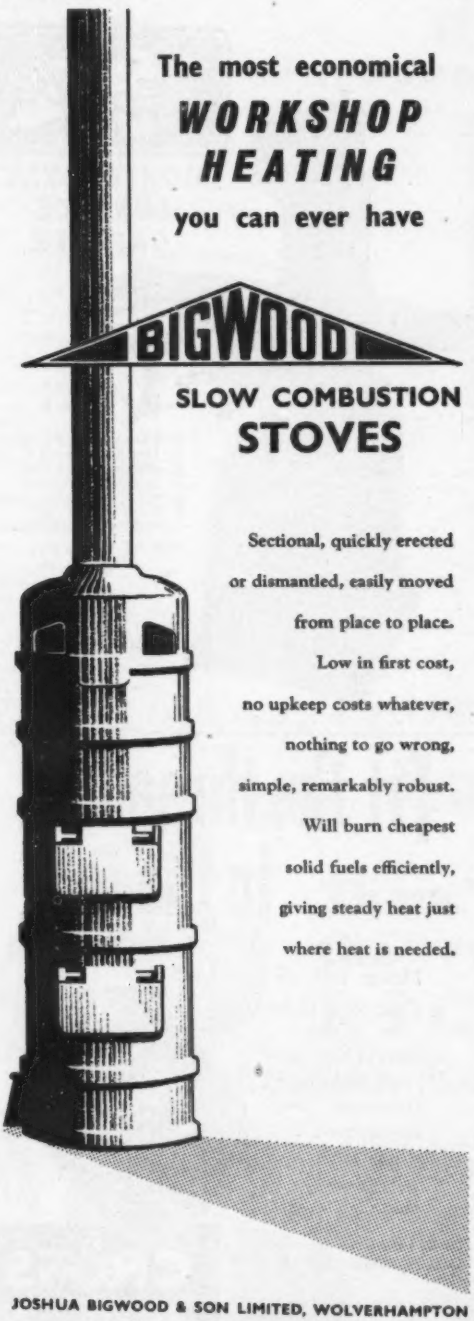
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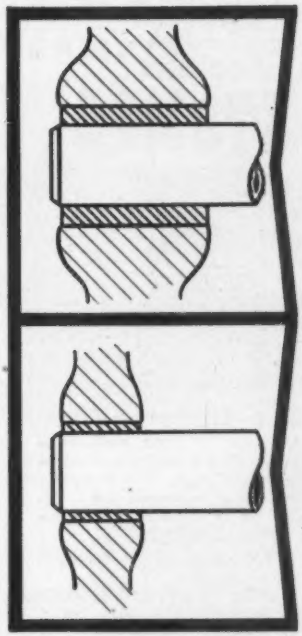
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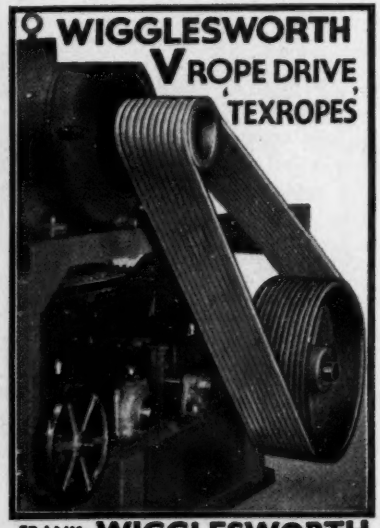
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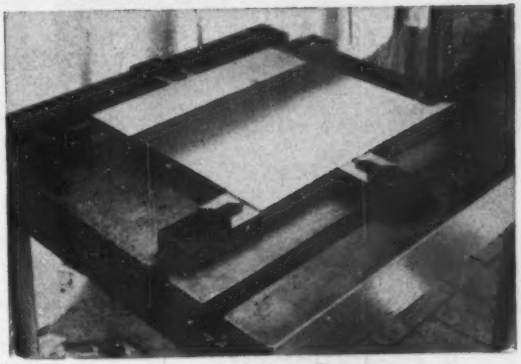
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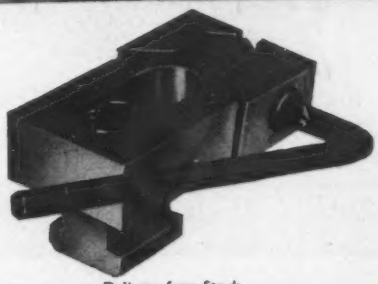
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2	60/1	£2 12 0	60/2	£3 3 0	3½	2	½	½	2
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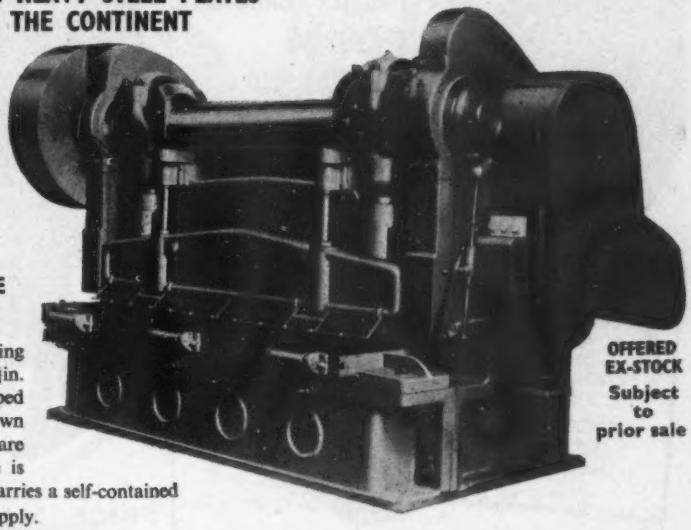


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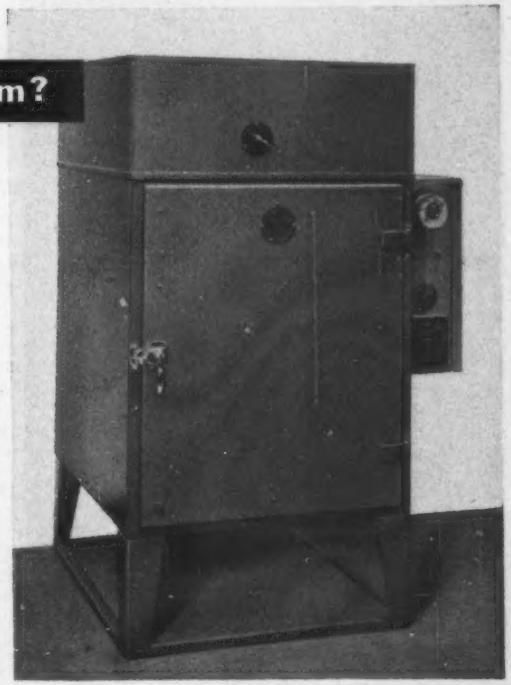
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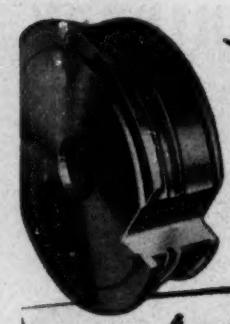
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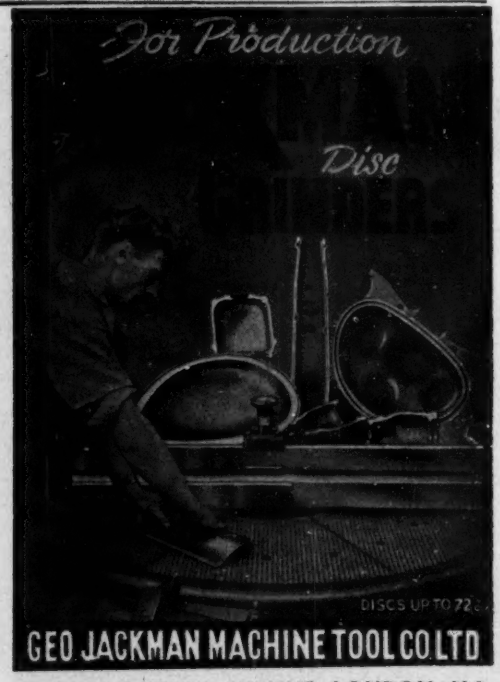
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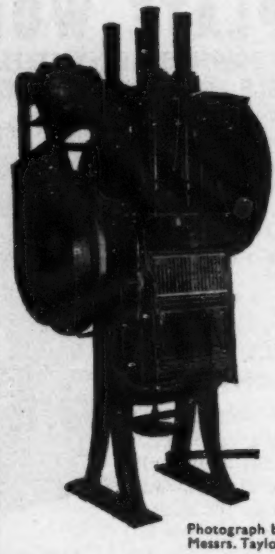
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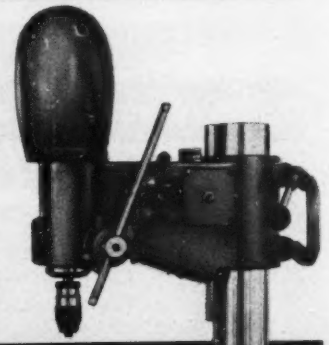
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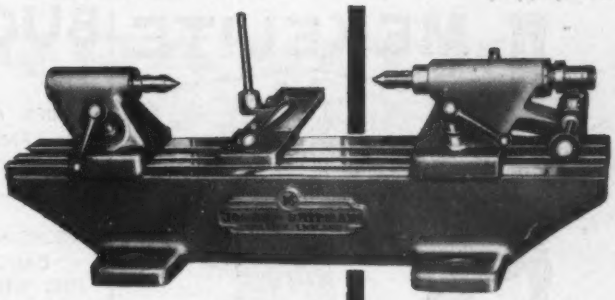


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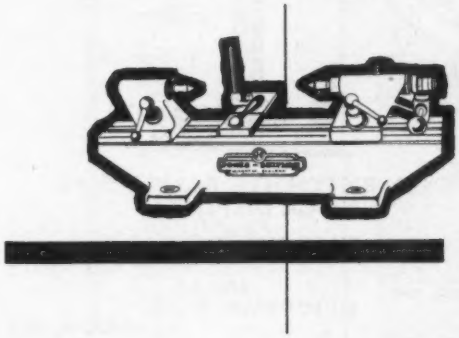
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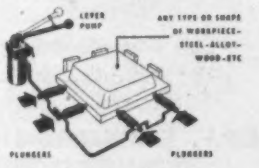


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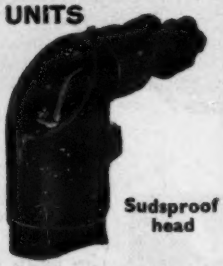
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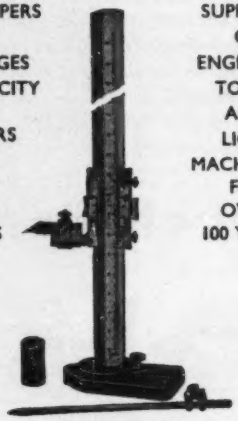
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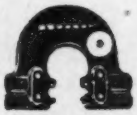
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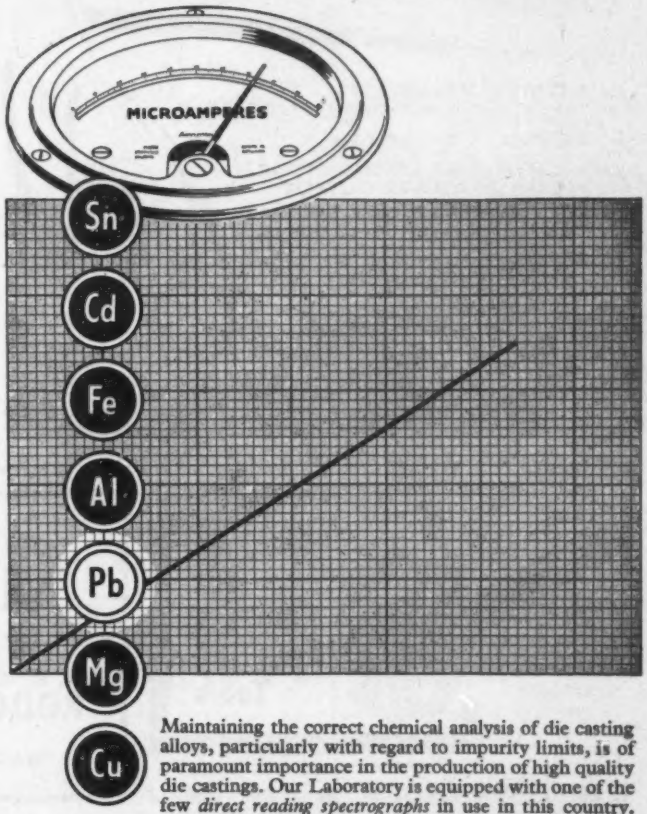
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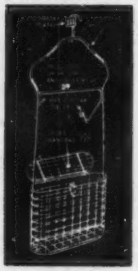
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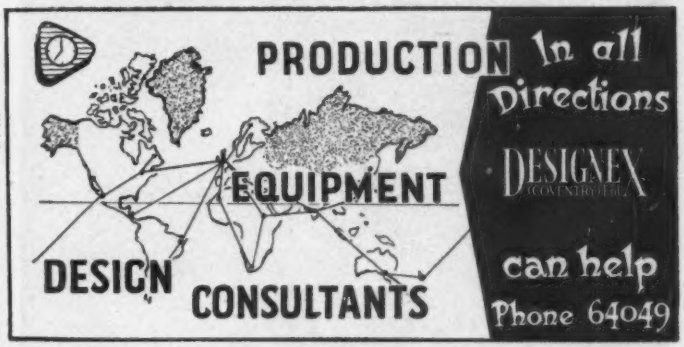
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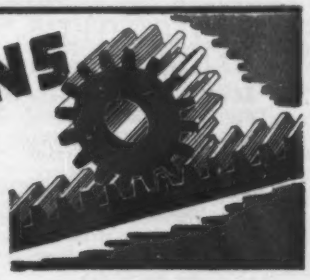
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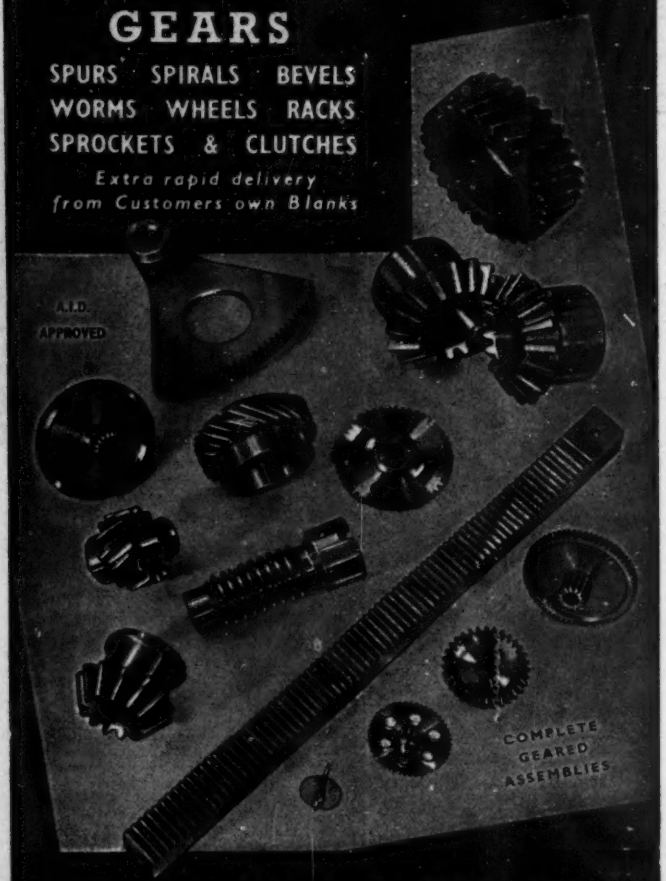
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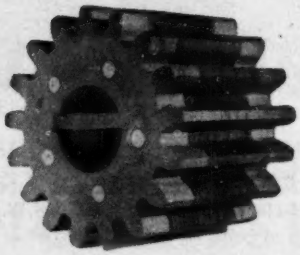
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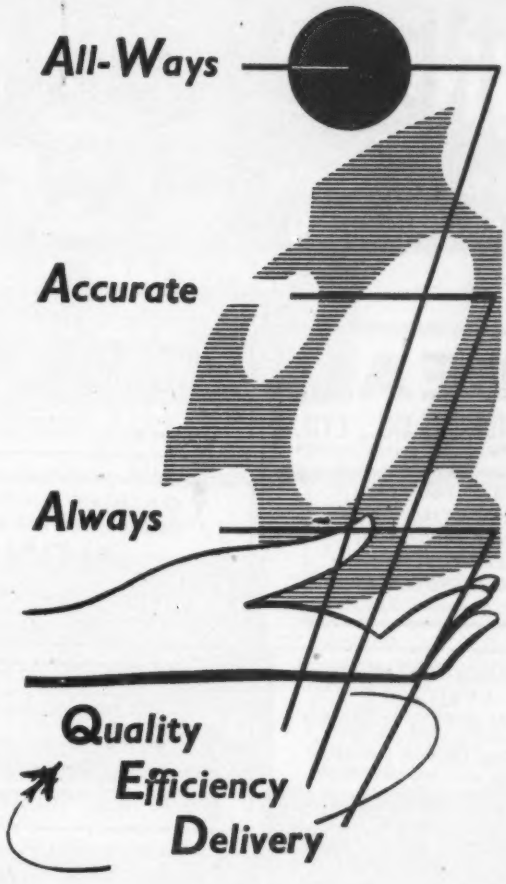
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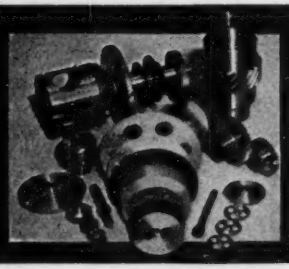
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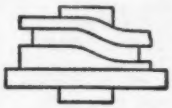
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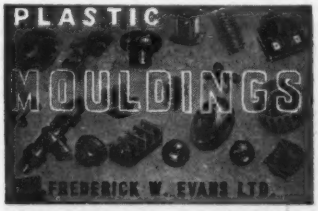
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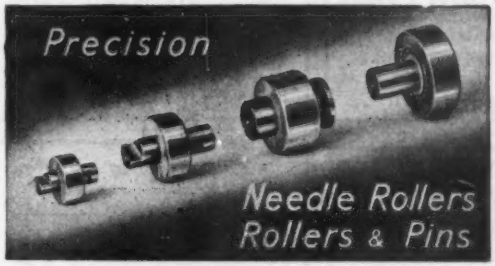
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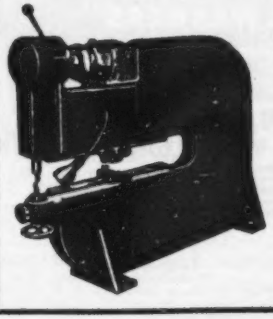
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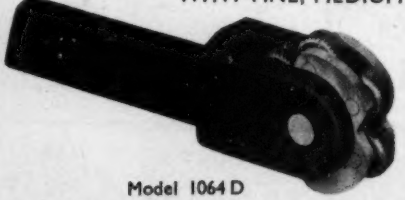
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200 Ton Tangye Hydraulic Straightening Press, bed 25ft. by 3ft., stroke 21in., motorised travelling table, 3 ram pump.
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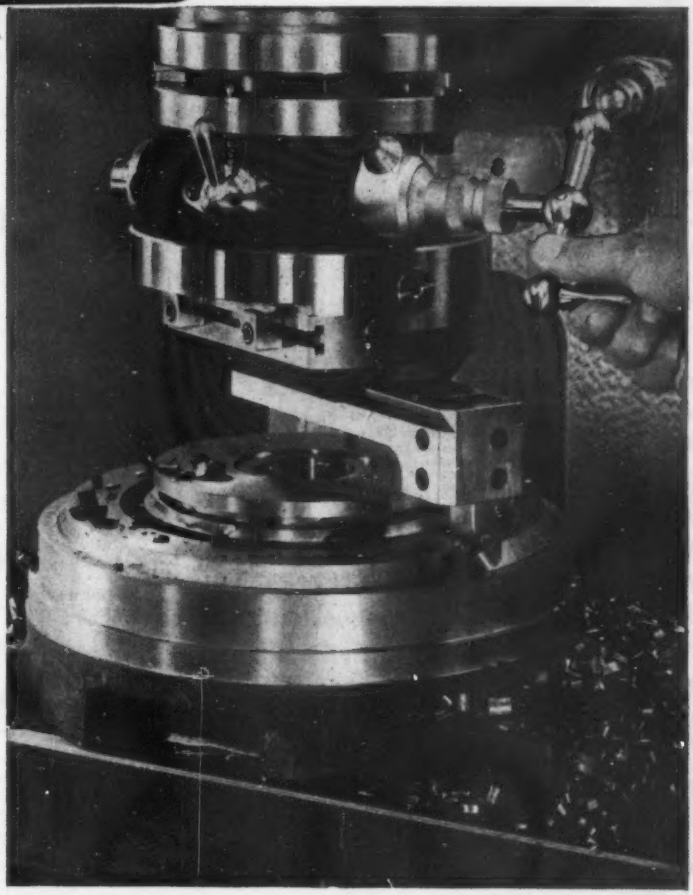
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New No. 2 KEARNS Patent Headed Horizontal Borer.
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V7 KITCHEN & WADE No. 5 M.T. Heavy Duty Pedestal Drill.
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NEWALL No. 1 Jig Boring Machine.

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COLCHESTER MASCOT 6½in. by 54in. All Geared Head Gap Bed Centre Lathe, 8 speeds 37 to 600 r.p.m. New.

DEAN SMITH & GRACE Type "A" 7in. by 30in. S.S. & S.C. Gap Bed Centre Lathe, totally enclosed gearbox, coolant pump and fittings, 4-way turret toolpost, stationary steady, 12in. dia. S.C. chuck, 12in. dia. 4-jaw independent chuck, 12in. and 22in. dia. faceplates, 12 speeds 11 to 490 r.p.m. Serial No. 21303.

HARRISON 11in. Swing by 22in. S.S. & S.C. Centre Lathe, Model L.6 with inbuilt Hydraulic Copying Attachment, on steel cabinet base. Four-way turret toolpost; 16 speeds 45 to 2,000 r.p.m. New.

MITCHELL 6½in. S.S. & S.C. Gap Bed Centre Lathe. Model N.M.I. Admits 64in. between centres and 2½in. diameter through spindle, complete with taper turning attachment, 4-jaw independent chuck, 3-jaw self centring chuck, travelling steady, 4-way toolpost, 12in. dia. faceplate, suds pump and fittings, 6 speeds 27 to 400 r.p.m. Excellent condition. Serial No. 2238.

REIDEN 7½in. by 40in. S.S. & S.C. Gap Bed Toolroom Lathe, taper turning. 20 speeds 20 to 1,350 r.p.m. Standard, metric and module threading. New.

WILLSON Mark I 6½in. by 24in. S.S. & S.C. Centre Lathe, sloping bed, totally enclosed leadscrew and feedshaft, nine speeds 52 to 954. New.

WILLSON 7½in. by 36in. Newel S.S. & S.C. Gap Bed Centre Lathe, 4-way toolpost, 8½in. dia. 3-jaw Taylor S.C. chuck. Nine speeds 26 to 477 r.p.m. Serial No. 03006.

WILLSON Mark V 7½in. by 48in. S.S. & S.C. Centre Lathe Gap Bed. Speed range either 52 to 954 or 37 to 739 r.p.m. New.

DRILLING MACHINES

ASQUITH 9ft. Elevating Arm Radial Drilling, Boring and Tapping Machine, with main and auxiliary spindles. Power down feed to both spindles and fine hand feed. Power traverse to arm and saddle. 27 speeds main spindle 8 to 420 r.p.m. 27 speeds Auxiliary spindle 22 to 1,135 r.p.m. Base size 9ft. by 4ft. 6in. D.C. electrics.

DENBIGH 1½in. Variable Speed Pillar Drilling Machine, Type V.S. Power down feed and fine hand feed, speeds infinitely variable 90 to 680 r.p.m. Circular table. NEW.

PROGRESS 3A Pillar Drilling Machine, 1½in. capacity, circular table. New.

RICHMOND S.R.2 36in. Sensitive Radial Drilling Machine, 1½in. capacity, 9 speeds 100 to 1,500 r.p.m. New.

GRINDERS

BURDETT Hydraulic Surface Grinder, Model 70, capacity 18in. by 6in. by 10in. New.

CINCINNATI No. 2 Tool and Cutter Grinder, with Internal Cylindrical and Surface Grinding Attachments, Visco Fan type dust extractor, Gear Cutter Shaping Attachment. Table size 36in. by 5¼in. Serial No. C.4007-8.

LANDIS Hydraulic Universal Grinder, type "C", capacity 10in. by 25in., with variable speed head and swivel table, wheel dressing attachment, coolant system Serial No. 27916.

NORTON Hydraulic Surface Grinder, capacity 10in. by 36in., fitted "Humphries" patent magnetic chuck. Toolroom condition. Serial No. M498.

NORTON Hydraulic Universal Grinder, capacity 12in. by 36in. U.S.A. built. Excellent condition. Serial No. L.332.

MILLING MACHINES Vertical

CINCINNATI No. 3 Dial Type Vertical Milling Machine, power down feed. 21 speeds 18 to 1,300 r.p.m. Table 62½in. by 15½in. Rapid and power traverses 34in. by 16in. by 16in., coolant pump and work light. Serial No. B4010-29.

TAYLOR Vertical Milling Machine, ⅜in. collet capacity, 4 speeds 430 to 2,090 r.p.m. Table 17½in. by 5in. Hand traverses 8⅜in. by 3½in. by 8½in. New.

Universal

DENBIGH C.4 Universal Milling Machine, 9 speeds 13 to 400 r.p.m. Table 46in. by 10in., automatic longitudinal feed 36½in. New.

EDGWICK No. 2 Universal Milling Machine, 9 speeds 24 to 405 r.p.m. Table 45in. by 11in., with Vertical head, Slotting head, Dividing head, Power longitudinal and cross feed 47in. by 7½in. Serial No. M.29718.

RICHMOND No. 3 Universal Milling Machine, 12 speeds 20 to 1,000 r.p.m. Table 48in. by 11in. Rapid and power traverses 30in. by 8in. by 16in. New.

VICTORIA U.2 Universal Milling Machine, 12 speeds 30 to 1,010 r.p.m. Table 45in. by 11in. Power feeds 29½in. by 14½in. by 8in. New.

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Cashmores

Selection of Machine Tools from Stock

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New MITCHELL OF KEIGHLEY 8¼in. S.S. & S.C. Lathe, to admit 4ft. 3in. between centres.
New MITCHELL OF KEIGHLEY 12¼in. S.S. & S.C. Lathe, to admit 9ft. 9in. between centres.
New MITCHELL OF KEIGHLEY 10¼in. S.S. & S.C. Lathe, to admit 7ft. 5in. between centres.
LANG 6¼in. S.S. & S.C. Lathe, to admit 2ft. between centres.
New COLCHESTER TRIUMPH 7¼in. S.S. & S.C. Lathe, cabinet base to admit 4ft. between centres.
LANG 8¼in. S.S. & S.C. Lathe, to admit 4ft. 0in. between centres.
COLCHESTER MASCOT 8¼in. S.S. & S.C. Lathe, to admit 4ft. 6in. between centres.
VOLMAN 8in. S.S. & S.C. Gap Bed Lathe, to admit 4ft. 6in. between centres.
F.L.C.B. 13in. S.S. & S.C. Heavy Duty Lathe, to admit 17ft. between centres, 2 saddles.

CAPSTAN LATHES

WARD 3A Capstan Lathe, with collet chuck and bar feed, 1¼in. capacity.
WARD 2A Capstan Lathe, with collet chuck and bar feed, 1¼in. capacity.

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TULLIS Horizontal Boring Machine, Floor Type with 3¼in. traversing spindle, 9ft. 0in. by 2ft. 6in. tee-slotted baseplate.

DRILLING MACHINES

PROGRESS 4E Pillar Drilling Machine, No. 3 M.T. spindle. New and used available.
New **RICHMOND** SR2 36in. Sensitive Radial Drilling Machine.

MILLING MACHINES

HERBERT 23V Vertical Milling Machine, 68in. by 17in. table.
CINCINNATI No. 3 Dial Type Vertical Milling Machine, 62¼in. by 15in. table, motorised.
ARCHDALE 18in. Vertical Milling Machine, 38in. by 10in. table.
CRAVEN "Rigidmill" Production Milling Machines, working surface of table 39in. by 13in., spindle speeds 25-400 r.p.m. Two machines available.
EDGWICK 18in. Production Milling Machine working surface of table 26in. by 12in.
New **VICTORIA** U1, U2 and U3 Universal Milling Machines.
ARCHDALE 20in. Horizontal Plain Milling Machine, 40in by 10in. table.
CUTTAT HYPERMIL Production Milling Machine, 43in. by 10in. working surface of table, with 4 automatic cycles to table.

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MEUSER 11¼in. Gap Bed Lathe, admit 80in. between centres.
CARDIFF 8¼in. Gap Bed Lathe, admit 48in. between centres.
KRETA 8in. Gap Bed Lathe, admit 40in. between centres. (Infinitely variable speed.)
WILSON 7¼in. Mark V Gap Bed Lathe, admit 36in. between centres.
CARDIFF 7¼in. Gap Bed Lathe, admit 40in. between centres.
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TAYLOR Vertical Miller, 17¼in. by 5¼in.
MARLOW Vertical Miller, 25¼in. by 6in.
VICTORIA U0 Universal Miller, 36in. by 9in.
VICTORIA Universal Millers from 36in. by 9in. to 72in. by 15in. tables.
RICHMOND No. 3 Universal Miller, 48in. by 11in.
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DENBIGH C4 Plain Miller, 46in. by 10in.
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WARD No. 7 Comb. Turret Lathe, 1940.
NILES 27in. × 27ft. Twin Saddle Lathe.
ACME-GRIDLEY RAC6 Chuck Auto.
CHURCHILL No. 1 Planetary Grinder
ORCUTT HM24 Gear Grinder, 1944.
CINCINNATI 1/18, 2/24 Prod. Mills.
RYDER WELLMAN Horiz. Borer, 3 Insp.
B. & S. OOG S.S. Autos, 1942.
LA POINTE 28L Horiz. Broach.
VICTORIA U2 Mill, with dividing hds., 1955.
ACME-GRIDLEY 2¼in. S.S. Auto, 1942.
MODERN 6in. × 18in. Surface Gdr., 1953.
CHURCHILL O8V 40in. × 10in. Vertical Spindle Surface Grinder, 1942.
ARCHDALE 30in. H.D. Pillar Drill, 1942.
GISHOLT 4, 5 and 1L Turret Lathes, 1941-43.
WARNER & SWASEY 3, 5 and 3A Turrets.
HERBERT 2D, 4, 4 Senior Turret Lathes.
B. & S. No. 3 Vert. Mill, 1942.
WARD 2A and 3A Capstans, 1942.
ARCHDALE 18in. and 30in. Vert. Mills, 1942.
CINCINNATI 2MH & No. 2 Plain Mills, 1942.
HEALD 48A S. End Borematics, 1941-44.
DEFIANCE No. 5 Hor. Borer, 3in. sp., 1941.
B.S.A. ¾in. S.S. Automatics, 1941.
CINCINNATI 1L and No. 2 Vert. Mills, 1942.
B. & S. No. 2 Universal Grinders, 1941
NEWALL 10 by 24/48 Grinders, 1942.
MONARCH Magnamatic Prod. Lathe, 1946
ORCUTT 5in. × 36in. Spline Grinder, 1944.
V.D.F. 10in. × 72in. Centre Lathe 1941.
CINCINNATI 3/24, 3/36 Hydromatics, 1945.
HERBERT 0, 1 and 3S Plain Mills, 1940.
P. & W. 12B 2-spindle Profiles, 1941.
KITCHEN & WADE No. 2 Cyl. Hone, 1940.
CHURCHILL NB 6in. × 18in. S. Gr., 1942.
CHURCHILL Centreless Gr., Model EC, 1940.
COCHRANE BLY No. 55 Cold Saw, 1940.
INDEX OR12 S.S. Auto, ¾in. cap., 1940.
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HILLE R.H.15 ⅝in. Bar feed.
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WARNER & SWASEY No. 2, 1in. Bar feed.
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ACME SW Universal Turret, 2in. Bar feed.
LIBBY 4A, 2in. Bar feed.
MURAD ⅝in. Bar feed.
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LE BLOND No. 2. T. & C.
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REINECKER 8 × 72in.
LEES BRADNER Mod. 40. 6¼in. H.M.
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CINCINNATI 5/60 Hydromatic 60in. Traverse to Table speeds 17 to 127. 15 h.p. 400/3/50, 1941.

KEARNS No. 2 Patent Horizontal Borer. 3in. spindle. 30in. facing speeds 3.1/246. Screwcutting. 1942.

CHURCHILL Model OSV Vertical Spindle Surface Grinder. Capacity 40in. × 10in. Hydraulic. 1942.

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New MITCHELL OF KEIGHLEY 12½in. S.S. & S.C. Lathe, to admit 8ft. 9in. between centres.
New MITCHELL OF KEIGHLEY 10½in. S.S. & S.C. Lathe, to admit 7ft. 5in. between centres.
LANG 6½in. S.S. & S.C. Lathe, to admit 2ft. between centres.
New COLCHESTER TRIUMPH 7½in. S.S. & S.C. Lathe, cabinet base to admit 4ft. between centres.
LANG 8½in. S.S. & S.C. Lathe, to admit 4ft. 0in. between centres.
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CHURCHILL Hyd. Vert. Surface (plough), cap. 18in. by 36in., segmental wheel 18in. dia. Humphrey mag. chuck, 12in. by 36in. mot. 415/3/50.
LANDIS Hydraulic Cylindrical Grinder, 12in. by 48in., mot., reconditioned.
NEWAL Hydraulic Cylindrical Grinder. 12in. by 24in., mot.
K.S. Internal Grinder, ⅜in. to 1¼in. dia., int. cap. Power feed to table, auto. sizing feeds, mot. 415/3/50. Late type machine, ex con.
OLIVETTI Automatic Hydraulic Cylindrical Grinder. Type R4/1200, 14in. swing by 38in. between centres. Plunge cut. Mot. 415/3/50.

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ALBA 24in., motorised.
BERRY 14in. Shaper, gearbox drive, mot.
PRATT & WHITNEY Slotter, 5½in. stroke, tilting ram.

PRESSES AND SHEET METAL, ETC.

RHODES Stagger Press, 25 ton, throat 24in.
OLIVER Quick Work Shear, cap. ¼in., throat 30in.
RHODES Fluifeed Hydraulic Guillotine, 6ft. by 14ft. Gauge, Micro stops.
THERMIC Muffle Furnace, 15in. by 24in. by 12in., has heated pyrometer 1,000 deg. C.
T. & C. B1½ and B2, motorised.
RHODES 40 ton inc., motorised.
BLISS No. 8, late type, motorised. £100.

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ASQUITH Radial LDR 3ft. 6in., motorised
PROGRESS Pillar 4E, motorised.

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BULLARD 36in. Vertical Borer. Swings 38in. 12 speeds 12 to 200 r.p.m. With side head. M.D. 400/3/50.

WEBSTER & BENNETT 36in. Vertical Borer. Swings 38½in. 12 speeds 10·4 to 199·4 r.p.m. M.D. 400/3/50.

BALLINGER Model C10 Abrasive Cutting Off Machine. Built 1951. Takes 16in. dia. wheels. Cuts 2in. solid M.S. bars, 3in. tubes. M.D. 400/3/50.

MITTS & MERRILL No. 3 Keyseater. Stroke 16in. To cut keyways up to 2in. wide. M.D. 400/3/50.

SWIFT 11in. S.S. & S.C. Lathe. Model 10V3. Built 1951. Admits 5ft. 9in. between centres. 12 speeds 14 to 500 r.p.m. M.D. 400/3/50.

LECRA 20½ ND Inclinable Power Press. Built 1943. Tonnage 25. Stroke 2in. M.D. 400/3/50.

New **KERRY** 100 11in. Pillar Drill. Spindle No. 3 M.T. T-slotted swing aside table, 9 speeds 70 to 1,500 r.p.m. M.D. 400/3/50.

New **KERRY** 125 AG 1¼in. Pillar Drill. Spindle No. 3 M.T. 9 speeds 70 to 1,500 r.p.m. Three rates of power feed. T-slotted table and base. M.D. 400/3/50.

HERBERT 50in. Horizontal Broaching Machine. 20-ton pull. Max. stroke 50in. Screw operated. M.D. 400/3/50.

WARD No. 7 Capstan with covered bed. Speeds to 750 r.p.m. Air operated chuck. M.D. 400/3/50.

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LECRA 18 ND Inclinable Press. Cap. 10 tons. Stroke 1¼in. With strip feed. M.D. 400/3/50.

CHURCHILL-REDMAN 18in. Heavy Duty Crank Shaper with Universal table. Table cants in two directions. 8 speeds. M.D. 400/3/50.

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HOLBROOK 8in. × 36in. S.S. & S.C. Lathe.
CHURCHILL-REDMAN 8in. × 30in. A.G.H. Gap Bed Lathe.
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HOGARTH 7in. × 40in. A.G.H. S.S. & S.C. Lathe.
VOLMAN 7in. × 60in. A.G.H. Gap Bed S.S. & S.C. Lathe.
KELLER Die-Sinking Machine, Mod. GG1210. Ser. No. 7578.
CINCINNATI 3/36 Hydromatic Duplex Mill.
ARCHDALE 30in. Vertical Mill.
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CINCINNATI No. 3 and No. 4 Vertical Mills.
ADCOCK & SHIPLEY No. 3 Hor. Mill.
CINCINNATI No. 4 Hor. Mill.
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EXCEL No. 3/12 Hydraulic Horizontal Spindle Surface Grinding Machine. Capacity 24in. by 8in. Coolant equipment. Motorised 400-440/3/50.

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VICTORIA U2 Universal Milling Machine. Spindle speeds 30-1,010 r.p.m. Table 45in. by 11in. Longitudinal traverse 30in. 400-440/3/50.

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NEWALL Type L 10in. by 24in. Plain Grinding Machine. 400-440/3/50.

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HULLER No. 5 Vertical Tapping Machine. 400-440/3/50.

POLLARD 21A Single Spindle Vertical Production Drilling Machine.

WICKSTEED Hydraulic 28in. Cold Sawing Machine. 400-440/3/50.

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DEAN, SMITH & GRACE 12in. Gap Bed Lathe by 3ft. 6in. b.c. 400-440/3/50.

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ARCHDALE 20in. Horizontal Plain Milling Machine, longitudinal feed 20in. 400-440/3/50.

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RICHARDS 6ft. Vert. Borer, 2 T.H. on cross rail, max. swing 74in., 1·9 to 25 r.p.m. table speeds.

HARVEY 30½in. Long Bed S.S. & S.C. Lathe, motor drive, two saddles with rapid power traverse, swing over bed 61in., admits between centres 61ft.

MONARCH 13½in. Geared Head S.S. & S.C. Lathe, type CM, 24in. motor drive, swing over carriage 14in., between centres 24ft.

LE BLOND 18in. Heavy Duty Geared Head Engine Lathe, swing over carriage 26in., admits between centres 28ft.

CRAVEN 14½in. S.S. & S.C. Lathe, motor drive, two saddles, swing over bed 29in., swing over carriages 20in. admits between centres 28ft.

SWIFT 48in. swing Surfacing and Boring Lathe, Model 12SV5, swing over bed 28in., over saddle 17½in., in gap 48in. by 24in. Sp. bore 4½in., 18 sp. speeds 4 to 230 r.p.m., h.p. 15.

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MODERN OPTICAL PROFILE GRINDING MACHINE.
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B.S.A. 9in. SINGLE SPINDLE CHUCKING AUTOMATIC. Complete with air-operated chuck.
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CHURCHILL 12in. by 36in. UNIVERSAL HYDRAULIC GRINDING MACHINE.

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Archdale 28in. Horizontal Miller with vertical milling attachment, 400/3/50.—HICKS MACHINERY, LTD., 26, Addison Place, London, W.11. Tel.: PARk 2333.

Rowland Duplex Grinder 30in., New condition, equipped for wet grinding.—BOX Z623, MACHINERY, Clifton House, Euston Road, N.W.1.

Reed Prentice No. 5 Vertical Miller, kneeless type; 72in. × 16in. table. 400/3/50. Weight about 6½ tons.—A. McNAMARA & CO., New Line, Bacup, Lancs. 'Phone: Bacup 946.

Milling Machines. Cincinnati 4/36 Hydromatic Serial 4009/1. Excellent condition. Cochrane & Bly No. 14 Universal Vertical Miller-Shaper. Archdale 24in. Production Mill with Autocycle (1946). Cincinnati 30in. by 8in. Plain. Wadkin LXA 36in. × 12in. Vertical. Pallas Model HO Plain, 30in. × 8in.—Pallas Model HOO Plain, 22in. × 7½in. Two Senior Model MI Plain Mills (new).—TATE MACHINE TOOL CO., LTD., 6, North End Parade (opp. Olympia), London, W.14. Telephone: Fulham 6563 (3 lines).

Webster & Bennett type D 36in. Vertical Borer, 1948.
Webster & Bennett type 3DH 36in. Vertical Borer, 1954.
Kitchen & Wade H5 Horizontal Drilling and Boring, 1953.
Darling & Sellers S.S. & S.C. Lathe, 12½in. × 8ft. 6in., 1953.
Dean, Smith & Grace S.S. & S.C. Lathe, 12in. × 11ft. 6in., 1941.
Swift S.S. & S.C. Lathe, gap bed, 9in. × 6ft. 6in., 1942.
Archdale 3ft. 6in. Low Base Radial, 1949.
Herbert 7 Junior Comb. Turret Lathe, 1941.
Herbert No. 4 Capstan Lathe, 1941.
Dean, Smith & Grace 17½in. Swing Facing and Boring Lathe, 1943.
Asquith 6ft. 0in. Low Base Radial, 1945.
Asquith 4ft. 6in. Low Base Radial, 1950.
Cincinnati No. 2 Tool and Cutter Grinder, 1943.
Wickman Automatic Cutter Grinder.
Lund Precimax MPL 6 × 24in. Cyl. Grinder, 1942.
Newall L 10 × 36in. Hyd. Cyl. Grinder, 1942.
Richmond O1 Plain Miller, 1943.
Kempsmith 2C Plain Miller, 1941.
Herbert 15S Vertical Miller, 1943.
Maiden 4in. Pipe and Bolt Screwing Machine, 1945.
Monarch 8in. S.S. & S.C. Toolroom Lathe, 1943.
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Free Lance Sales Representative required to sell Swiss machines in Northern England area to present customers and also to open new accounts. These are small precision machines and have been sold in the United Kingdom for the past thirty years. Details required—when replying—of types of products sold at the present moment, business contacts, previous experience, commission required, etc. —BOX Z607, MACHINERY Clifton House, Euston Road, N.W.1.

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Chief Inspector, I.E.M.E., A.I.D., A.R.B. approved, desires similar position London district.—BOX Z536, MACHINERY, Clifton House, Euston Road, N.W.1.

Works Manager, 38, Seeks Pro- gressive post, 22 years' experience all departments light precision engineering, including toolroom, drawing office, sales, buying, estimating and production. Present position responsible for running company manufacturing press tools, jigs, fixtures and moulds to the trade, also precision parts. Would consider position as technical representative.—BOX Z533, MACHINERY, Clifton House, Euston Road, N.W.1.

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An Engineering Executive, 39, requires situation. Experienced manager, D.O., Toolroom, Production, Works. Electro mech. instruments, special-purpose machines, presswork, tooling, plastics.—BOX Z628, MACHINERY, Clifton House, Euston Road, N.W.1.

Senior Estimator/Planner with practical tool design and workshop experience, light/medium engineering, seeks post preferably South Coast area. Would accept responsibility as Works Manager with small progressive firm.—BOX Z574, MACHINERY, Clifton House, Euston Road, N.W.1.

REPRESENTATIVES

Technical Representative, Mech- anical Engineer, seeks position. Limited rep. experience. Wide knowledge design, manufacture electronic and mechanical special-purpose machines, press tools, plastic moulding jigs, fixtures.—BOX Z629, MACHINERY, Clifton House, Euston Road, N.W.1.

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INDEX TO ADVERTISERS

	PAGE
Abbey Heat Treatments Ltd.	154
A.B.M.T.M. Ltd.	15, 16 & 17
Abwood Machine Tools Ltd., The	26
Acbars Ltd.	179
Access Equipment Ltd.	70
Acru Electric Tool Mfg. Co. Ltd., The	143
A.E.W. Ltd.	145
Alexander, Geo. H. Machinery Ltd.	14 & 161
Alleyne Foster Eng'g. Co. Ltd.	157
Almco Supersheen Division of G.B. Ltd.	34
A.M.T. (Birmingham) Ltd.	123
Anderton Springs Ltd.	150
Ashtead Eng'g. Co. Ltd.	158
Atkin, W. T. (Tottenham) Ltd.	159
Automotive Products Co. Ltd.	62
Autoproductions Ltd.	156
Avenue Eng'g. Co., The	158
Aylesbury Turned Parts (True Screws) Ltd.	156
Ballinger, L. J. H. Ltd.	140
Bamber, John Eng'g. Ltd.	28
Barber & Colman Ltd.	*Inside Back Cover*
Bedford, James & Co. (Halifax) Ltd.	138
Bell, H. (Machine Tools) Ltd.	166, 175 & 180
Benson Bond	120
Benton Eng'g. Co. Ltd.	156
Biswood, Joshua & Sons Ltd.	141
Blaker Motor & Welding Co. Ltd., The	152
Bliss, E. W. (England) Ltd.	95
Boneham & Turner Ltd.	130
Bowes Road Eng'g. Co. Ltd.	156
Brauer, F. Ltd.	128
British Timken Ltd.	77
British Vapour Blast Ltd.	116
Broadbent, Henry Ltd.	83
Brock, L. & T. L. & Co. Ltd.	157
Broom & Wade Ltd.	8
Brown, David Corporation (Sales) Ltd., The	121
Brown, F.	152
Brown's Eng'g. Works	158
B.S.A. Tools Ltd.	71
Buck & Hickman Ltd.	53
Buck & Ryan Ltd.	148
Buckingham, G. M. Ltd.	174 & 176
Burdett, G. W. S. & Co. Ltd.	135
Burton, Griffiths & Co. Ltd.	71
Butcher, Henry & Co.	165
Butler Machine Tool Co. Ltd., The	17
Butterworth British Automatic Tool Co. Ltd.	68
Butterworth, A. & Co.	166
Camdentools	160
Campbells & Hunter Ltd.	122
Carder, R. E. Ltd.	160
Carobronze Ltd.	141
Carron Co.	155
Cashmore, John Ltd.	172
Castle Eng'g. Co. (Nottingham) Ltd.	114
Catmur Machine Tool Corporation Ltd.	44
Centaur Tool Works	176
Centec Machine Tools Ltd.	60
Central Engineers (Herne Hill) Ltd.	159
Churchill, Chas. & Co. Ltd.	47
Cinetra Manufacturing Co. Ltd.	154
Clarkson (Engineers) Ltd.	91
Cohen, Geo. Sons & Co. Ltd.	29
Colchester Lathe Co. Ltd., The	9 & 10
Coventry Grinders Ltd.	161
Cox & Danks Ltd.	137
Crabtree, J. A. & Co. Ltd.	12
Crane Packing Ltd.	100
Craven Bros. (Manchester) Ltd.	31
Crompton Parkinson Ltd.	51
Cross Manufacturing Co. (1938) Ltd.	142
Crowthorn Eng'g. Co. Ltd.	20
Croydon Tool & Case Hardening Specialists	154
Davall Gear Co. Ltd., The	152
Davies-Charlton (U.K.) Ltd.	153
Dean, Smith & Grace Ltd.	64
De Bergue Machine Tools Ltd.	140
Denfords Eng'g. Co. Ltd.	55
Designex (Coventry) Ltd.	151
Dimco (Great Britain) Ltd.	168
Donovan Electrical Co. Ltd., The	162
Dormer & Wadsworth Ltd.	159
Dowding & Doll Ltd.	6, 7 & 136
Drayton Regulator & Instrument Co. Ltd.	144
Drummond-Asquith (Sales) Ltd.	19, 102 & 103
Drummond Bros. Ltd.	19
Eagle Milling Machine Co. Ltd.	151
Eclipse Foundry & Eng'g. Co. (Dudley) Ltd.	153
Economic Stampings Ltd.	158
Edmonton Tool & Eng'g. Co. Ltd.	159
Edwards, F. J. Ltd.	27, 145, 165, 166, 172 & 174
Eeeset Gauges Ltd.	148
Elgar Machine Tool Co. Ltd.	43, 69 & 162
Elliott, B. (Machinery) Ltd.	33
E.M.B. Co. Ltd.	106
Engineering Products Ltd.	162
English Electric Co. Ltd., The	45
English Steel Tool Corp. Ltd.	49
E.N.V. Eng'g. Co. Ltd.	148
Epco Ltd.	112
Erma Ltd.	139
Evans, Fredk. W. Ltd.	157
F.E.M. Eng'g. Co.	126
Fenner, J. H. & Co. Ltd.	48
Finucane, Wm. (Springs & Pressings) Ltd.	162
Flexello Castors & Wheels Ltd.	116
Forrest, W. & Co. Ltd.	165

(Continued on page 184)

INDEX TO ADVERTISERS—(*continued from page 183*)

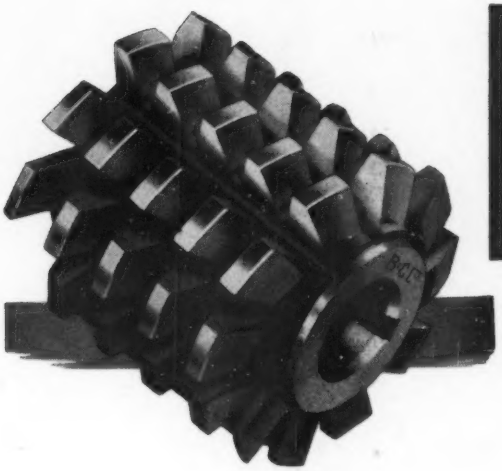
	PAGE
Fraser, Douglas & Sons Ltd.	86
Fuller, Horsey Sons & Cassell	114
F.U. London Ltd.	180
G.A. Precision Products Ltd.	159
Gills Pressure Castings Ltd.	108
Gisholt Machine Co. (G.B.) Ltd.	65
Goulder, J. & Sons Ltd.	105
Gray, R. O.	170, 173, 174 & 178
Gribben-Davies (Machine Tools) Ltd.	175
Griffiths, Gilbart Lloyd & Co. Ltd.	136
G.R.M. Heat Treatments Ltd.	154
Grosvenor Works (Holloway) Ltd.	161
Gunn, D. A. (Eng'g.) Ltd.	157
Halifax Rack & Screw Cutting Co. Ltd.	132
Hammond Eng'g. Co. Ltd., The	162
Harbots Ltd.	138
Harper, John & Co. Ltd.	41
Harris, John Tools Ltd.	*Back Cover*
Harrison, R. C. & Sons (Brassfounders) Ltd.	144
Harrison, T. S. & Sons Ltd.	57
Herbert, Alfred Ltd.	5 & 39
High Speed Service Tool Co. Ltd.	156 & 160
Highwood Eng'g. Co. Ltd., The	107
Hill, John & Sons (Ironfounders) Ltd.	134
Hillman Electric Motors Ltd.	110
Hoffmann Manufacturing Co. Ltd., The	54
Holbrook Machine Tool Co. Ltd.	37
Holly Eng'g. (Drayton) Ltd.	160
Holroyd, John & Co. Ltd.	18
Humphreys, J. H. & Sons Ltd.	144
Humphris & Sons Ltd.	78
Hunt, Herbert & Sons Ltd.	137
Huntley & Sparks Ltd.	158
Ideal Hardening Co. Ltd.	154
Imperial Chemical Industries Ltd.	90
Jackman, Geo. Machine Tool Co. Ltd.	146
Jameson, J. L. Ltd.	94
J.B. Machine Tool Co. Ltd.	164 & 172
Johansson, C. E. Ltd.	86
Jones, A. A. & Shipman Ltd.	61 & 147
Jones, E. H. (Machine Tools) Ltd.	13, 164 & 175
Kayser, Ellison & Co. Ltd.	87
Keelavite Rotary Pumps & Motors Ltd.	63
Keeton, Sons & Co. Ltd.	89
Kemp Precision Tooling Ltd.	159
Kemworthy Jig & Press Tool Co., The	159
K.E.N.T. Machinery & Eng'g. Co.	166
Kirk, Harry Eng'g. Ltd.	178
Knott, A. & T. Bros. Ltd.	4
Lacy Hulbert & Co. Ltd.	46
Lafarge Aluminous Cement Co. Ltd.	113
Landen (Engineers) Ltd.	151
Lang, John & Sons Ltd.	16
Lapointe Machine Tool Co. Ltd., The	75
Lattimer, E. R. Ltd.	156
Lawrence, A. & Co. (Machine Tools) Ltd.	164 & 179
Layton, M. C. Ltd.	164
Lenchs (Birmingham) Ltd.	161
Lethaby, Wm. & Co. Ltd.	134
Levy, B. & Co. (Patterns) Ltd.	154
Leyton Eng'g. Co. Ltd.	155
Lines, J. H. Ltd.	150
Lip Industry	132
Litton's Machine Tool Co. Ltd.	170
Lloyd, Richard Ltd.	*Front Cover*
Lodge Plugs Ltd.	128
Lowton Metals Ltd.	161
Lumsden Machine Co. Ltd.	3
MacDowall Equipment Co. Ltd.	160
MacEchern & Co. Ltd.	152
Machinery Publishing Co. Ltd., The	117 & 149
Manifold Machinery Co. Ltd.	155
Marsden & Shiers Ltd.	158
Martin Bros. (Machinery) Ltd.	165
Martonair Ltd.	74
Matthews, Chas. E. (Machine Tools) Ltd.	174
Maun Industries Ltd.	108
Maurall Eng'g. Co.	158
Mek-Elek Eng'g. Ltd.	148
Mercer, Thomas (Air Gauges) Ltd.	52
Midland Machine Tool Co., The	164 & 178
Millen, Edwin	164
Mills, George (Engineers) Ltd.	153
Mitcham Jig & Press Tool Co. Ltd.	160
Modern Machine Tools Ltd.	168
Mokes, S. F. & Co. Ltd.	58
Mortimer Eng'g. Co.	73, 110 & 146
Moser Cams & Tools Ltd.	146
Munro, R. W. Ltd.	152
Murray, H. D. Ltd.	130
Naish Bros. & Co. Ltd.	159
Neill, James & Co. (Sheffield) Ltd.	*Inside Front Cover & 76*
Nettlefold & Moser Ltd.	2
Newall, A. P. & Co. Ltd.	92
Newall, Alexander S. Machine Tool Co. Ltd.	184
Newall Used Machine Division	176
Newman Industries Ltd.	169
Non-Ferrous Diecasting Co. Ltd.	110
Norton Industries Ltd.	101
Norton, T. & Co. Ltd.	42
Norton, W. E. (Machine Tools) Ltd.	171
Novogage Ltd.	154
Ormerod, R. E. Ltd.	151
Ormond Eng'g. Co. Ltd., The	30
Park Gate Iron & Steel Co. Ltd., The	40
Parkin, F. M. (Sheffield) Ltd.	93
Peterborough Die Casting & Machine Co. Ltd.	109
Pidgen Bros. Ltd.	173
Pilot Plug Gauge Co. Ltd., The	23
Polarcold Ltd.	158
Pollard, Fredk. & Co. Ltd.	66
Power Jacks Ltd.	147
Power Petroleum Co. Ltd., The	81
Precision Grinding Ltd.	38
Precision Heating Ltd.	154
Precision Products (Romford) Ltd.	151
Precision Rubbers Ltd.	126
Preconomy Co. Ltd.	160
Premier Precision Ltd.	153
Price Machine Guards Ltd.	146
Pringle, Robert & Sons	154
Purefoy, J. B. Unit Tooling Ltd.	50
Qualters & Smith Bros. Ltd.	125
Raistrick, J. E. Ltd.	164
Rawlplug Co. Ltd., The	*Inside Back Cover*
Redcar Eng'g. Co. Ltd.	156
Redgrave Dean & Co. Ltd.	124
Reid Gear Co. Ltd., The	127
Renold Chains Ltd.	67
Revolving Centres Ltd.	140
Richards, Charles & Sons Ltd.	143
Rockwell Machine Tool Co. Ltd.	35 & 36
Rodgers Bros. Ltd.	150
Rosser & Russell Ltd.	156
Roth, L.	176
Rozalex Ltd.	148
Rubert & Co. Ltd.	119
Rye, Claude Bearings	161 & 163
Salter, George & Co. Ltd.	129
Sanders, H. G. & Son Ltd.	159
Schrader's Son, A.	84
Sciaky Electric Welding Machines Ltd.	22
Seton Creaghe Eng'g. Ltd.	151, 153 & 156
Shardlow Micrometers Ltd.	131
Shaw, A. & Son (Diamonds) Ltd.	124
Sheffield Twist Drill & Steel Co. Ltd., The	82
Shelmerdine & Mulley Ltd.	156
Sieber, James Equipment Co. Ltd.	150
Simplex Electric Co. Ltd.	158
Slingsby, Walter & Co. Ltd.	150
Smith & Netherwood Ltd.	158
Sosg Machine Tools Ltd.	11 & 177
Solex (Gauges) Ltd.	104
Southern Eng'g. & Machinery Co.	164
Sparklets Ltd.	149
Spectra Chemicals Ltd.	97
Stalker Drill Works Ltd., The	96
Stancroft Ltd.	165
Standwell Equipment Co. Ltd., The	142
Steel-Craft Jig & Tool Co.	160
Stein Atkinson Vickers Hydraulics Ltd.	98
Stephens Belting Co. Ltd.	120
Stephens, E. & Son Ltd.	160
Stevens & Bullivant Ltd.	118
Stewarts & Lloyds Ltd.	21
Straight & Vines Ltd.	174
Stubs, Peter Ltd.	105
Surplice & Toner Eng'g. Co. Ltd.	155
Swindon Tool Co. Ltd.	88
Sykes Machine Tool Co. Ltd.	80
Tarex (England) Ltd.	59
Target Eng'g. Ltd.	118
Tate Machine Tool Co. Ltd.	175
Taylor, Chas. (Birmingham) Ltd.	115
Taylor Rustless Fittings Co. Ltd.	153
Tecalemit Ltd.	32
Thames Valley Pattern Works Ltd.	154
Teroy Ltd.	72
Toone, B. (Nottingham) Ltd.	154
Trevena & Glover Ltd.	159
Tufnol Limited	79
Tungsten Mnfg. Co. (1958) Ltd.	139
Universal Ball Bearing Co.	162
Universal Eng'g. Co.	108
Urquhart, Wm.	122, 164, 174 & 176
Valor Co. Ltd., The	112
Vaughan Associates Ltd.	133
Victa Eng'g. Co.	142
Vinell, D. & Son Ltd.	119
Ward, H. W. & Co. Ltd.	15
Ward, M. (Machine Tools) Ltd.	164 & 170
Ward, Thos. W. Ltd.	168
Webster & Bennett Ltd.	99
Western Machine Tools (Swansea) Ltd.	166
Whittam & Co.	162
Wickman Ltd.	24 & 25
Widdowson, Herbert & Sons Ltd.	162 & 167
Wigglesworth, Frank & Co. Ltd.	142
Wild-Barfield Electric Furnaces Ltd.	1
Williams, H. Ltd.	183
Williams & Iliffe Ltd.	151
Windley Bros. Ltd.	56
Woking Pattern Works	155
Wolverhampton Die Casting Co. Ltd.	111
Worson Die Cushions Ltd.	144
Wuster Bruder	162
Zephyr Engineers Ltd.	157

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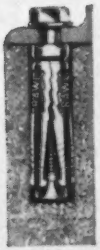
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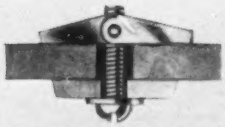
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